STANAG No. 4545
Ratification Draft 1

NORTH ATLANTIC TREATY ORGANISATION
(NATO)

MILITARY AGENCY FOR STANDARDISATION
(MAS)

STANDARDISATION AGREEMENT
(STANAG)

SUBJECT: NATO Secondary Imagery Format
Format d' Imagerie Secondaire OTAN

Promulgated on

Chairman, MAS

RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date Entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardisation Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the Custodian. Nations may propose changes at any time to the Custodian where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "In NATO Standardisation, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardisation Agreement" (AAP-6).

5. Implementation is "In NATO Standardisation, the fulfilment by a member nation of its obligations as specified in a Standardisation Agreement" (AAP-6).

6. Reservation is "In NATO Standardisation, the stated qualification by a member nation that describes the part of a Standardisation Agreement that it will not implement or will implement only with limitations" (AAP-6).

RATIFICATION, IMPLEMENTATION, AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the Custodian of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.

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RATIFICATION AND IMPLEMENTATION DETAILS
STADE DE RATIFICATION ET DE MISE EN APPLICATION

NATION	NATIONAL RATIFICATION REFERENCE DE LA RATIFICATION NATIONALE	NATIONAL IMPLEM-ENTING DOCUMENT NATIONAL DE MISE EN APPLICATION	IMPLEMENTATION/MISE EN APPLICATION					
			FORECAST DATE PREVUE			ACTUAL DATE DATE REELLE		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
	(1)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
BE								
CA								
DA								
FR								
GE								
GR								
IT								
LU								
NL								
NO								
PO								
SP								
TU								
UK								
US								

• See reservations overleaf/Voir reservés au verso(4)
+ See comments overleaf/Voir commentaires au verso (5)
X Service(s) implementing/Armées mettant en application (7)
Releasable to NACC/PfP Y Non Releasable Y (8)

NATO EFFECTIVE DATE (6)
DATE D'ENTREE EN VIGUEUR OTAN

EXPLANATORY NOTES ON RATIFICATION AND IMPLEMENTATION DETAILS

(1) a. One ratifying reference is entered for each nation. All dates are to be shown as follows: "of/du 23.3.81".

b. If a nation has:

(1) Not signified its intentions regarding ratification of the STANAG or an amendment thereto, the space is left blank.

(2) Decided not to ratify the STANAG, the words "NOT RATIFYING/NE RATIFIE PAS' is entered.

(2) List the national implementing document(s); this may be the STANAG itself or an AP.

(3) When nations give a forecast date for their implementation, it is entered in the forecast column (month and year only). Implementation dates are transferred from the forecast to the actual date column when notified by a nation.

(4) Reservations are to be listed as stated by each nation.

(5) If a nation has indicated that it will not implement "NOT IMPLEMENTING/NE MET PAS EN APPLICATION" is entered; where reasons are given they are placed after the reservations under the heading "comments".

(6) When a NED or forecast NED has been determined it is entered here.

(7) In the case of a covering STANAG with an NED, an "X" is inserted in the implementation column showing the services implementing the AP.

(8) In the case of an Unclassified STANAG, nations have or have not authorised the release of the STANAG to NACC/PfP Partners.

NATO STANDARDISATION AGREEMENT (STANAG)

NATO SECONDARY IMAGERY FORMAT

Annexes:
A. Terms and Definitions
B. NSIF Concept of Operations
C. NSIF File Format
D. Standard Geospatial Support Data Extensions
E. Complexity (Compliance) Levels

The following STANAGS, Military Standards (MIL-STD), ITU-T Recommendations and International Standards contain provisions which, through references in this text, constitute provisions of this STANAG. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this STANAG are encouraged to investigate the possibility of applying the most recent editions of the STANAG, MIL-STDs, Recommendations and Standards listed below. NATO maintains registers of currently valid STANAGS.

Referenced Documents:

IEEE 754	-	IEEE Standard for binary floating point arithmetic
ISO 1000	-	SI units and recommendations for the use of their multiples and of certain other units
ISO/IEC 7498-1	-	Information technology - Open systems interconnection - Basic reference model: The basic model
ISO/IEC 8632-1	-	Information technology - Computer graphics - Metafile for the storage and transfer of picture description information: Functional specification
ISO/IEC 8632-1 AMD1	-	Rules for profiles
ISO/IEC 8632-1 AMD2	-	Application structuring extensions
ISO/IEC 10646-1	-	Information technology - Universal Multiple-Octet Coded Character Set (UCS): Architecture and basic multilingual plane
ISO/IEC 10918-1	-	Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines
ISO/IEC DIS 10918-3	-	Information technology - Digital compression and coding of continuous-tone still images: Extensions
ISO/IEC 12087-5	-	Information technology - Computer graphics and image processing - Image Processing and Interchange (IPI) - Functional specification: Basic Image Interchange Format (BIIF)
ITU-R RECMN BT.601-5	-	Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios
ITU-T RECMN T.4 AMD2	-	Terminals for telematic services - Standardisation of group 3 facsimile apparatus for document transmission
JIEO Circular 9008	-	National Imagery Transmission Format Standards (NITFS) Certification Test & Evaluation Program Plan
MIL-STD-188-199	-	Vector Quantization Decompression for the National Imagery Transmission Format Standard
MIL-STD-2301	-	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard
STANAG 1059	-	National Distinguishing Letters for use by NATO Forces
STANAG 2215	-	Evaluation of Land Maps, Aeronautical Charts and Digital Topographic Data
STANAG 3277	-	Air Reconnaissance Request/Task form

STANAG 7023	-	Air Reconnaissance Imagery Data Architecture
STANAG 7024	-	Imagery Air Reconnaissance Tape Recorder Standard
STANAG 7074	-	Digital Geographic Information Exchange Standard (DIGEST) - AGeoP-3A

Related Documents:

DMA TR 8350.2	-	World Geodetic System 1984, 2d addition
DMA TR 8358.1	-	Datums, Ellipsoids, Grids, and Grid Reference System
ISO 8601	-	Data elements and interchange formats - Information interchange - Representation of dates and times
ISO 8879	-	Information processing - Text and office systems - Standard Generalised Mark-up Language (SGML)
ISO/IEC 9069	-	Information processing - SGML support facilities - SGML Document Interchange Format (SDIF)
ISO 11172-2	-	Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s: Video
ISO/IEC 13818-1	-	Information technology - Generic coding of moving pictures and associated audio information: Systems
ISO/IEC 13818-2	-	Information technology - Generic coding of moving pictures and associated audio information: Video
ISO/IEC 13818-3	-	Information technology - Generic coding of moving pictures and associated audio information: Audio
ISO 10918-4	-	Information technology - Digital compression and coding of continuous-tone still images: Registration procedures for JPEG profile, APPn marker, and SPIFF profile ID marker
MIL-STD-6040	-	Message Text Format
Q-STAG 509	-	Military Symbols
STANAG 2019	-	Military Symbols for Land Based Systems
STANAG 2211	-	Geodetic Datums, Ellipsoids, Grids and Grid References
STANAG 4420	-	Display Symbology and Colours for NATO Maritime Units
STANAG 5500	-	NATO Message Text Formatting System (FORMETS) - ADatP-3
STANAG 7085	-	Interoperable Data Links for Imaging Systems

AIM

1. The aim of this agreement is to promote interoperability for the exchange of Electronic Secondary Imagery among NATO C^3I Systems. The NATO Secondary Imagery Format (NSIF) is the standard for formatting digital imagery and imagery-related products and exchanging them among members of NATO.

2. This standard establishes the requirements for the file format component of the NSIF. The file format described in this document is called the NSIF. The NSIF is a collection of related standards and specifications developed to provide a foundation for interoperability in the dissemination of imagery and imagery-related products among different computer systems.

AGREEMENT

3. This NATO Standardisation Agreement (STANAG) is promulgated by the Chairman of the MAS under the authority vested in him by the NATO Military Committee. No departure may be made from the agreement without consultation with the Custodian. Participating nations agree to exchange secondary imagery in accordance with this agreement. Nations may propose changes at any time to the control authority where they will be processed in the same manner as the original agreement. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. The terms and definitions used in this document are listed in Annex A.

GENERAL SECTION

5. This agreement contains five annexes with associated appendixes. Annex A lists the terms and definitions that apply to this agreement. Annex B explains the NSIF concept of operations. Annex C contains the file format structure and the data content for all fields defined within a NSIF file. It includes five appendices. Appendix 1 includes the tables referred to in Annex C. Appendix 2 shows a NSIF file example, and Appendix 3 addresses NSIF implementation issues. Appendix 4 depicts the structure of a sample NSIF file. Appendix 5 describes the concepts for single images per file, multiple images per file, and multiple files per product. Annex D contains the description of standard Geospatial support data extensions (SDE), why they are needed, and how they maintain accuracy, source, and coordinate data during the transfer of geospatial information. The SDEs are included in an appendix to Annex D. Annex E describes the complexity levels that systems may be certified to.

DETAILS OF AGREEMENT

6. The NSIF standardsation agreement defines a presentation layer protocol as defined in the International Standards Organisation - Open Systems Interconnection model (ISO/IEC 7498-1). The NSIF standard alone does not guarantee interoperability. Compatibility must also be assured at other protocol layers. Certifiable implementation of the NSIF for support of interoperability is subject to constraints not specified in this STANAG.

IMPLEMENTATION OF THE AGREEMENT

7. This STANAG is implemented by a nation when it has issued instructions that all such equipment procured for its forces will be manufactured in accordance with the characteristics detailed in this agreement.

ANNEX A. TERMS AND DEFINITIONS

1. Acronyms. The following acronyms are used for the purpose of this agreement.

a.	AL	-	Attachment Level
b.	API	-	Application Program Interface
c.	BCS	-	Basic Character Set
d.	BCS-A	-	Basic Character Set-Alphanumeric
e.	BCS-E	-	Basic Character Set - Extended
f.	BCS-N	-	Basic Character Set-Numeric
g.	BE	-	Basic Encyclopaedia
h.	BIIF	-	Basic Image Interchange Format. See ISO/IEC 12087-5.
i.	BMP	-	Basic Multilingual Plane
j.	C	-	Conditional
k.	CAT Scan	-	Computerised axial tomography scan
l.	CCS	-	Common Coordinate System
m.	CE	-	Controlled Extension
n.	CGM	-	Computer Graphics Metafile
o.	COTS	-	Commercial Off The Shelf
p.	CRT	-	Cathode Ray Tube
q.	C^3I	-	Command, Control, Communications, and Intelligence
r.	DES	-	Data Extension Segment
s.	DGIWG	-	Digital Geographic Information Working Group
t.	DIGEST	-	DIgital Geographic information Exchange STandard
u.	DL	-	Display Level
v.	DOD	-	Department of Defence of the United States
w.	DTG	-	Date-Time-Group
x.	DTM	-	Digital Terrain Model
y.	EEI	-	1. External Environment Interface 2. Essential Elements of Information
z.	IC	-	Image Compression

aa.	IEEE POSIX	-	Institute of Electrical and Electronic Engineers Portable Operating System Interface
ab.	ILOC	-	Image Location
ac.	IREP	-	Image REPresentation
ad.	ISO	-	International Organisation for Standardisation
ae.	ITU	-	International Telecommunication Union
af.	JPEG	-	Joint Photographic Experts Group
ag.	LSB	-	Least Significant Bit
ah.	LUT	-	Look-Up Table
ai.	MGRS	-	Military Grid Referencing System
aj.	MPEG	-	Motion Picture Experts Group
ak.	MSB	-	Most Significant Bit
al.	MTF	-	Message Text Format
am.	NBPC	-	Number of Blocks Per Column
an.	NBPR	-	Number of Blocks Per Row
ao.	NOSE	-	NATO Open Systems Environment
ap.	NOSIP	-	NATO Open System Interconnection Profile
aq.	NPPBH	-	Number of Pixels Per Block Horizontal
ar.	NPPBV	-	Number of Pixels Per Block Vertical
as.	NSIF	-	NATO Secondary Imagery Format
at.	NSIFS	-	NATO Secondary Imagery Format Standard
au.	OADR	-	Originating Agency's Determination is Required
av.	OSE	-	Open System Environment
aw.	OSI	-	Open Systems Interconnect model
ax.	PVTYPE	-	Pixel Value Type
ay.	R	-	Required
az.	RES	-	Reserved Extension Segment
ba.	RGB	-	Components from video standardisation: R for Red, G for Green, B for Blue
bb.	SBND	-	Defines boundary limits for the graphic
bc.	SDE	-	Support Data Extension
bd.	SDIF	-	SGML Document Interface Format
be.	SGML	-	Standardised Graphic Mark-up Language
bf.	SID	-	Secondary Imagery Dissemination

bg. SIDS - Secondary Imagery Dissemination System

bh. SIT - Secondary Imagery Transmission

bi. SLOC - Graphic Location

bj. TFS - Transportable File Structure (see ISO/IEC 12087-5)

bk. UCS - Universal Multiple Octet Coded Character Set

bl. UDHD - User Defined Header Data

bm. UDID - User Defined Image Data

bn. UN - United Nations

bo. UTM - Universal Transverse Mercator

bp. VQ - Vector Quantization

bq. YCbCr - Y = Brightness of signal, Cb = Chrominance (blue), Cr = Chrominance (red). See ITU-R RECMN BT.601-5

2. Terms and definitions. The following terms and definitions are used for the purpose of this agreement.

a. Attachment Level. A way to associate images and graphics to the same level during movement, rotation, or display.

b. Band. A well defined range of wavelengths, frequencies or energies of optical, electric, or acoustic radiation. At the pixel level, a band is represented as one of the vector values of the pixel.

c. Bandwidth. (1) The difference between the limiting frequencies within which performance of a device, in respect to some characteristic, falls within specified limits. (2) The difference between the limiting frequencies of a continuous frequency band.

d. Base Image. The base image is the principle image of interest or focus for which other data may be inset or overlaid. The NSIF file can have none, one, or multiple base images.

e. Basic Character Set. A subset of the Basic Multilingual Plane (BMP). The Basic Character Set consists of the characters defined in the first row (row 0x00) of the BMP A-zone. For this reason the first octet normally used to define character positions in the BMP will be omitted when expressing BCS character codes. Valid BCS character codes, therefore, shall range from 0x00 through 0xFF.

f. Basic Character Set-Alphanumeric. A subset of the Basic Character Set. The range of allowable characters consists of space through tilde, codes 0x20 through 0x7E, 0x0A, 0x0C, and 0x0D.

g. Basic Character Set-Numeric. A subset of the Basic Character Set-Alphanumeric. The range of allowable characters consists of minus through the number “9”, BCS codes 0x2D through 0x39, and plus, code 0x2B.

h. Basic Character Set-Numeric (integer). A subset of the Basic Character Set-Numeric. The range of allowable characters consists of number “0” through the number “9”, BCS codes 0x30 through 0x39.

i. Basic Multilingual Plane. The Basic Multilingual Plane is the first plane of the first group of the Universal Multiple-Octet Coded Character Set as defined by ISO/IEC 10646-1. The BMP is a matrix consisting of 256 rows each containing 256 cells. Individual cells are indexed using a pair of octets expressed in hexadecimal format. The first octet indicates the row containing the cell and the second octet indicates the position of the cell in the specified row. Rows within the BMP are grouped into four zones: A-zone (rows 0x00 through 0x4D), I-zone (rows 0x4E through 0x9F), O-zone (rows 0xA0 through 0xDF), and R-zone (rows 0xE0 through 0xFF). The A-zone is used for alphabetic and syllabic scripts together with various symbols. The I-zone is used for unified East Asian ideographs. The O-zone is reserved for future standardisation. The R-zone is restricted for graphic characters that are used in ways not explicitly constrained by ISO/IEC 10646-1.

j. BCS Space. BCS code 0x20

k. Block. A block is a rectangular array of pixels (Synonymous with tile.)

l. Block Image. A blocked image is comprised of the union of one or more non-overlapping blocks. (Synonymous with tiled image.)

m. Blocked Image Mask. A structure which identifies the blocks in a blocked (tiled) image which contain no valid data, and which are not included in the file. The structure allows the receiver to recognise the offset for each recorded/transmitted block. For example, a 2x2 blocked image file which contained no valid data in the second block (block 1) would be recorded in the order: block 0, block 2, block 3. The blocked image mask would identify block 1 as a non-existing block, and would allow the receiving application to construct the image in the correct order.

n. Brightness. An attribute of visual perception, in accordance with which a source appears to emit more or less light. A pixel with a larger value is brighter than a pixel with a lower value.

o. Byte. A sequence of eight adjacent binary digits.

p. Character. (1) A letter, digit, or other graphic that is used as part of the organisation, control, or representation of data. (2) One of the units of an alphabet.

q. Common Coordinate System. The virtual two dimensional Cartesian-like coordinate space which shall be common for determining the placement and orientation of displayable data.

r. Conditional. A state applied to a NSIF header or subheader data field whose existence and content is dependent on the existence and/or content of another field.

s. Coordinated Universal Time. The time scale maintained by the Bureau International de l'Heure (International Time Bureau) that forms the basis of a coordinated dissemination of standard frequencies and time signals.

t. Data communication. The transfer of information between functional units by means of data transmission according to a protocol.

u. Data Segment. A subheader and associated data.

v. Date-Time-Group. A composite representation of date and time.

w. Digraph. A two letter reference code.

x. Grey scale. An optical pattern consisting of discrete steps or shades of grey between black and white.

y. Image. A two-dimensional rectangular array of pixels indexed by row and column.

z. Image codes. For a vector quantized image file, values in the image data section that are used to retrieve the v x h kernels from the image code book.

aa. Imagery Associated Data. Data which is needed to properly interpret and render pixels; data which is used to annotate imagery such as text, graphics, etc.; data which describes the imagery such as textual reports; and data which support the exploitation of imagery.

ab. Interface. (1) A concept involving the definition of the interconnection between two equipment items or systems. The definition includes the type, quantity, and function of the interconnecting circuits and the type, form, and content of signals to be interchanged via those circuits. Mechanical details of plugs, sockets, and pin numbers, etc., may be included within the context of the definition. (2) A shared boundary, e.g., the boundary between two subsystems or two devices. (3) A boundary or point common to two or more similar or dissimilar command and control systems, subsystems, or other entities against which or at which necessary information flow takes place. (4) A boundary or point common to two or more systems or other entities across which useful information flow takes place. (It is implied that useful information flow requires the definition of the interconnection of the systems which enables them to interoperate.) (5) The process of interrelating two or more dissimilar circuits or systems. (6) The point of interconnection between user terminal equipment and commercial communication-service facilities.

ac. Kernel. For a vector quantized image file, a rectangular group of pixels used in the organisation of quantizing image data.

ad. Look-Up Table. A collection of values used for translating image samples from one value to another. The current sample value is used as an index into the look-up table(s); therefore, the number of entries in each look-up table for a binary image would contain two entries, and each look-up table for an 8-bit image would contain 256 entries. Multiple look-up tables allow for the translation of a 1-vector pixel value to an n-vector pixel value.

ae. Magnification. The multiplication factor which causes an apparent change in linear distance between two points in an image. Thus a magnification of 2 is a change which doubles the apparent distance between two points (multiplying area by 4), while a magnification of 0.5 is a change which halves the apparent distance.

af. Military Grid Referencing System. A means of expressing UTM coordinates as a character string, with the 100-kilometre components replaced by special letters (which depend on the UTM zone and ellipsoid).

ag. Network. (1) An interconnection of three or more communicating entities and (usually) one or more nodes. (2) A combination of passive or active electronic components that serves a given purpose.

ah. Non-blank. Non-blank indicates that the field cannot be filled with BCS spaces (code 0x20), but may contain the character BCS space when included with other characters. (embedded blanks)

ai. Null. The field is filled entirely with BCS spaces (code 0x20).

aj. Open Systems Interconnect model. This model is defined in ISO/IEC 7498-1.

ak. Pack Capable System. A system which is capable of generating a NSIF file.

al. Pad Pixel. A pixel with sample values that have no significant meaning to the image. Pad pixels are used with block images when either the number of pixel rows in an image is not an integer multiple of the desired number of vertical image blocks, or when the number of pixel columns in an image is not an integer multiple of the desired number of horizontal image blocks. In all cases, the sample values for pad pixels shall not appear within the bounds of significant sample values for pixels which comprise the original image.

am. Pad Pixel Mask. A data structure which identifies recorded/transmitted image blocks which contain pad pixels. The pad pixel mask allows applications to identify image blocks which require special interpretation due to pad pixel content.

an. Parity. In binary-coded systems, the oddness or evenness of the number of ones in a finite binary stream. It is often used as a simple error-detection check and will detect (but not correct) the occurrences of any single bit error in the field.

ao. Pixel. A pixel is represented by an n-vector of sample values, where n corresponds to the number of bands comprising the image.

ap. Primary Imagery. Unexploited, original imagery data that has been derived directly from a sensor. Elementary processing may have been applied at the sensor, and the data stream may include auxiliary data.

aq. Processed Imagery. Imagery that has been formatted into image pixel format, enhanced to remove detected anomalies and converted to a format appropriate for subsequent disposition.

ar. Protocol. (1) [In general], A set of semantic and syntactic rules that determines the behaviour of functional units in achieving communication. For example, a data link protocol is the specification of methods whereby data communication over a data link is performed in terms of the particular transmission mode, control procedures, and recovery procedures. (2) In layered communication system architecture, a formal set of procedures that are adopted to facilitate functional interoperation within the layered hierarchy. Note: Protocols may govern portions of a network, types of service, or administrative procedures.

as. Pseudocolour. A user-defined mapping of n-bits into arbitrary colours.

at. Required. A NSIF header or subheader field that must be present and filled with valid data.

au. Reconstruction. For a vector quantized image file, the process of transforming an image from a quantized form into a displayable and exploitable form.

av. Resolution. (1) The minimum difference between two discrete values that can be distinguished by a measuring device. (2) The degree of precision to which a quantity can be measured or determined. (3) A measurement of the smallest detail that can be distinguished by a sensor system under specific conditions. Note: High resolution does not necessarily imply high accuracy.

aw. Sample. The atomic element of an image pixel having a discrete value. One sample from the same location in each band comprising an image will combine to form a pixel.

ax. Secondary Imagery. Secondary Imagery is digital imagery and/or digital imagery products derived from primary imagery or from the further processing of secondary imagery.

ay. Secondary Imagery Dissemination. The process of dispersing or distributing digital secondary imagery.

az. Secondary Imagery Dissemination System. The equipment and procedures used in secondary imagery dissemination.

ba. Tile. Synonymous with block.

bb. Transparent Pixel. A pixel whose sample values must be interpreted for display such that the pixel does not obscure the display of any underlying pixel.

bc. Trigraph. A three letter reference code.

bd. Universal Multiple Octet Coded Character Set. The Universal Multiple Octet Coded Character Set is used for expressing text that must be human readable, potentially in any language of the world. It is defined in ISO/IEC 10646-1.

be. Universal Transverse Mercator. A system of grids for global use between latitudes 84 degrees North and 80 degrees South. The range of longitudes 180 degrees West to 180 degrees East is divided into 60 zones, each of which is a grid based on the Transverse Mercator projection. The actual grid depends on the choice of geodetic datum as well as the zone.

bf. Unpack Capable System. A system which is capable of receiving/processing a NSIF System file.

bg. Vector Quantization. A structuring mechanism in which many groups of pixels in an image are replaced by a smaller number of image codes. A clustering technique is used to develop a codebook of "best fit" pixel groups, or kernels, to be represented by the codes. A form of compression is achieved because the image codes can be recorded using fewer bits than the original pixel groups they represent.

bh. vsize. For a vector quantized image file, the size of the kernel in pixels.

bi. v x h kernel. For a vector quantized image file, a rectangular group of pixels (kernels) with v-rows and h-columns.

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ANNEX B. NSIF OPERATIONAL CONCEPT

1. General. Among NATO nations multiple types of systems are used for the reception, transmission, storage, and processing of images, graphics, text, and associated data. Without special efforts, the file format used in one system is likely to be incompatible with the format of another system. Since each system may use a unique, internal data representation, a common format for exchange of information across systems is needed for interoperability of systems within and among NATO nations. As the need for imagery-related systems grows, their diversity is anticipated to increase. The need to exchange data is also anticipated to increase, even though systems of each nation must retain their own individual characteristics and capabilities. This document defines the NSIF, the standard file format for imagery and imagery-related products to be used by NATO. The NSIF provides a common basis for storage and interchange of images and associated data among existing and future systems. The NSIF can be used to support interoperability by simultaneously providing a data format for shared access applications, while also serving as a standard file format for dissemination of images and associated data (text, graphics).

2. Relationship of NSIF to NOSE. The NATO Open Systems Environment (NOSE, Version 2, September 1995) provides technical guidance in the areas of design and procurement of C^3I systems to take advantage of the benefits of open systems and the new technologies available in the commercial market. It should be clear that adherence to the NOSE guidance should result in cost savings over the life-cycle of systems, improve portability and scaleability, provide interoperability, enhance efficiency during the development process, etc. In order to extend the NATO Open System Interconnection Profile (NOSIP) concept and the related ISO Open Systems Interconnection (OSI) Reference Model to the broader areas of application software portability and interoperability, the definition of a NATO Information Systems Reference model is required. To avoid confusion with the OSI Reference Model, it has been called the "NATO Open Systems Environment (OSE)" Reference model. The NATO OSE Reference Model is a set of concepts, entities, interfaces and diagrams that provides a basis for information system users to express their requirements to the provider community in a mutually agreeable context. It provides a basis for the specification of information technology standards necessary to develop, integrate, and maintain information systems and their infrastructure. This model has been generalised to such a degree that it can accommodate a wide variety of general and special purpose systems. The OSE Reference model is not a new development, but is based on the existing models from IEEE POSIX and the US DOD Technical Architecture Framework for Information Management. The NATO OSE Reference Model supports the successful implementation of open systems within NATO. It should be noted that the NATO OSE Reference Model is evolutionary in nature. Standards will continue to emerge and evolve as the state-of-the-art is continually pushed forward. Future needs and contexts will have to be defined. Within this overall reference model, NATO Open Systems standard interfaces, protocols, services and supporting formats will have to be defined. This reference model is necessary to establish a context for understanding how the disparate technologies required as part of a future NATO OSE relate to each other, and to provide a mechanism for identifying the key issues associated with application software portability and interoperability. The NATO OSE Reference Model does not impose any architectural constraints. Its purpose is to provide a common conceptual framework, define a common vocabulary and specify a base of standards for NATO project and procurement staff. The NATO OSE Reference Model consists of the 3 basic components: the Application Software Entity, the Application Platform Entity, and the External Environment. The two interfaces between the 3 basic components consist of the Application Program Interface (API) and the External Environment Interface (EEI). The application platform is the set of resources that provide the services upon which an application or application software would call, and is meant to make the applications independent of the underlying hardware. It provides services at its interfaces that, as much as possible, make the implementation-specific characteristics of the platform transparent to the application software. Application platform resources are accessed via Application Program Interfaces (API's). The SIT/SID functionality may be categorised as a Data Interchange Service within the Application Platform Entity. For these types of services the following standards are recommended (March 1997): SGML, SDIF, CGM, JPEG, MPEG-1, MPEG-2.

3. NSIF operations concept. The NSIF will be used for transmission and storage of secondary imagery within and among NATO C^3I nodes. The NSIF has direct application to the dissemination of secondary imagery to requesters of imagery derived intelligence. Multimedia intelligence reports will be composed and packaged into a single file which answer the Essential Elements of Information (EEIs) of a particular requester. The intelligence reports may be composed of textual reports along with images, annotated images, graphics, and maps. Intelligence reports are generated after an interpreter exploits primary images or further exploits a secondary image pulled out of an archive. Figure B-1 illustrates example formats used in the exploitation process of the reconnaissance cycle.

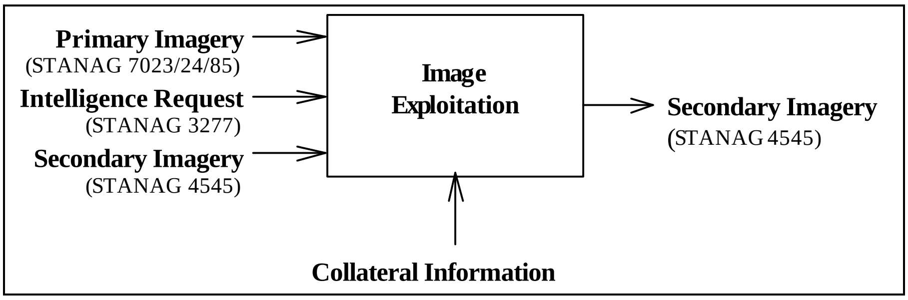


Figure B-1. NSIF operational concept

In the NSIF concept, data interchange between systems is enabled by a potential cross-translation process. When systems use other than NSIF as an internal imagery format, each system will have to translate between the system's internal representation for files and data, and the NSIF file format. A system from which data is to be transferred is envisioned to have a translation module that accepts information, structured according to the system's internal representation for images, annotations, text files, and other data, and assembles this information into one file in the standard NSIF file format. Then the file will be exchanged with one or more recipients. The receiving systems will reformat the file, converting it into one or more files structured as required by the internal representation of the receiving station. The functional architecture of this cross-translation process is shown on Figure B-2. In the diagram, the terms "$Native_1$ File Format" and "$Native_2$ File Format" refer to files represented in a way potentially unique to the sending or receiving system. Using the NSIF, each system must be compliant with only one external file format that will be used for interchange with all other participating systems. The standard format allows a system to send data to several other systems since each receiving system converts the file into its own native file format. Each receiving system can translate selectively and permanently store only those portions of data in the received file that are of interest. This allows a system to transmit all of its data in one file, even though some of the receiving systems may be unable to process certain elements of the data usefully. NSIF can also serve as the internal native file format so any translation would be eliminated.

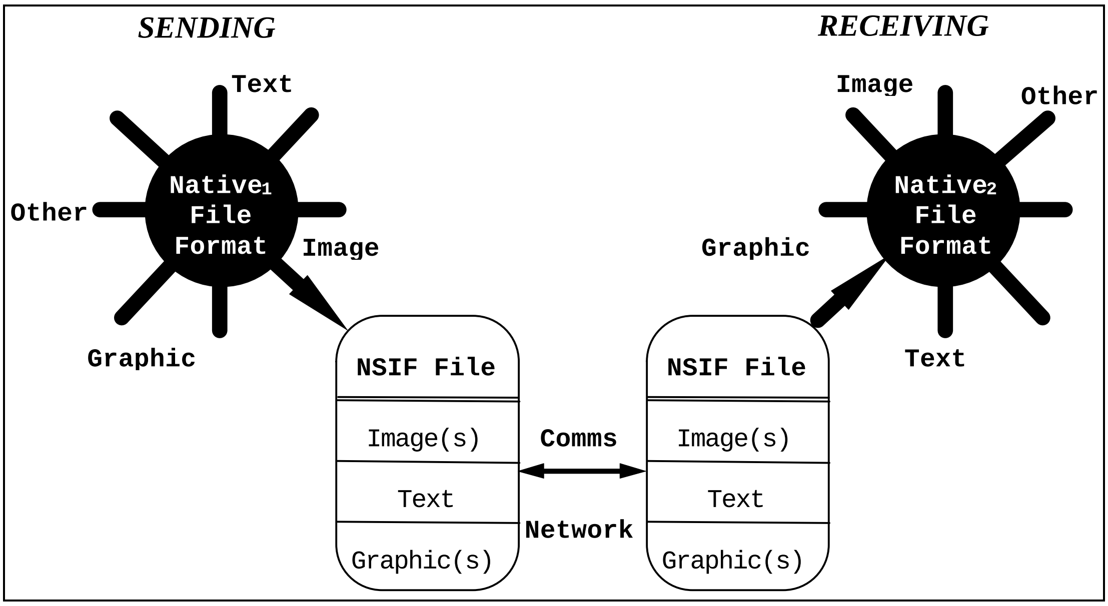


Figure B-2. NSIF functional architecture

4. NSIF design objectives. The design objectives of the NSIF are as follows:

a. To provide a means whereby diverse systems can share imagery and associated data.

b. To allow a system to send comprehensive information within one file to users with diverse needs or capabilities, allowing each user to select only those data items that correspond to their needs and capabilities.

c. To minimise the cost and schedule required to achieve such capability.

5. NSIF general requirements. The NSIF is specified to satisfy several general requirements in response to the role it plays in the NSIFS functional architecture. These requirements are:

a. To be comprehensive in the kinds of data permitted in the file within the image-related objectives of the format, including geolocated imagery or image related products.

b. To be implementable across a wide range of computer systems without reduction of available features.

c. To provide extensibility to accommodate data types and functional requirements not foreseen.

d. To provide useful capability with limited data formatting overhead.

6. NSIF characteristics. To serve a varied group of users exchanging multiple types of imagery and imagery-related data who are using differing hardware and software systems, the NSIF strives to possess the following characteristics:

a. Completeness - allows exchange of all needed imagery and imagery-related data.

b. Simplicity - requires minimal pre-processing and post-processing of transmitted data.

c. Minimal overhead - minimised formatting overhead, particularly for those users transmitting only a small amount of data and for bandwidth-limited users.

d. Universality - provides universal features and functions without requiring commonality of hardware or software.

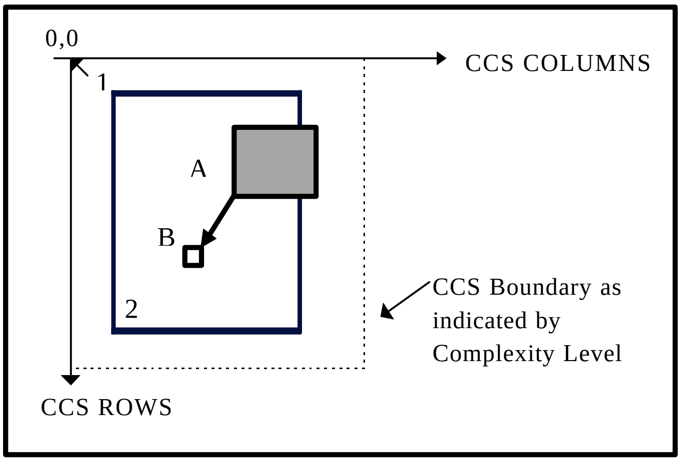
7. Associated segments. Associated segments shall be grouped in a package by subheader-data structure within a file, as shown in Figure B-3.

FILE						
File Header	Segment		...		Segment	
	Sub-Header	Data	...	...	Sub-Header	Data

Figure B-3. File structure

8. Common coordinate system. The Common Coordinate System (CCS) is the virtual two dimensional Cartesian-like coordinate space which shall be common for determining the placement and orientation of displayable data types within a specific NSIF file and among correlated NSIF files which comprise an integrated product.

a. Common coordinate system structure. The virtual CCS structure can be conceived of as a two dimensional drawing space with a coordinate system similar in structure to the lower right quadrant of the Cartesian coordinate system. The CCS has two perpendicular coordinate axes, the horizontal column axis and the vertical row axis as depicted in Figure B-4. The positive directions of the axes are based on the predominate scan (column) and line (row) directions used by the digital imagery community. The intersection of the axes is designated as the origin point with the coordinates (0,0). Given the orientation of the axes in Figure B-4, the positive direction for the column axis is from (0,0) and to the right; the positive direction for the row axis is from (0,0) downward. The quadrant represented by the positive column and positive row axes is the only coordinate space for which NSIF displayable data types may be located.



1. Common Coordinate System Origin (0,0 - 2048,2040)
2. Image
A. Image
B. Graphic (Box & Arrow)

Figure B-4. Common coordinate system example

b. Row and column coordinates. Displayable data types shall be placed in the CCS according to the row and column coordinates placed in subheader location fields (e.g. ILOC, SLOC). The location coordinates of a specific data item represent row and column offsets from either the CCS origin point (when 'unattached'), or the location point in the CCS of the data item to which the item is attached. Other means used to locate displayable data shall be directly correlated to row and column coordinates (e.g. displayable tagged extension data might have geolocation data correlated with row and column indices). When location coordinates are relative to the CCS origin, they shall always have a positive value. When location coordinates are relative to the location coordinates of an item to which they are attached, both positive and negative offset values are possible. In all cases, the location coordinates selected for any data item shall ensure that none of the displayable item extends outside of the quadrant defined by the axes of the CCS.

c. Complexity level constraints. The upper and left boundaries of the CCS are explicitly constrained in the specification. When complexity level constraints are specified, one of the key attributes for specification shall be to identify the lower and right boundary drawing space constraints for a given complexity level.

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ANNEX C. NSIF FILE FORMAT

Appendix 1. NSIF Tables
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FORMAT DESCRIPTION

1. Fixed fields. The format contains file header, subheader, and data fields. The NSIF file header and subheader fields are byte aligned. A file header carries information about the identification, classification, structure, content, size of the file as a whole, and the number and size of the major component segments within the file. For each type of data segment supported by the format, there is an associated subheader and data field. A subheader contains information that describes characteristics of the item, followed by an associated field that contains the actual data.

2. Extension fields. Flexibility to add support for the kinds of data and data characteristics not explicitly defined in this standard is provided within the format. This is accomplished by providing for conditional fields in each header/subheader indicating the presence of "tagged records" and providing for a group of "data extension segments." The tagged records in the headers/subheaders may contain additional characteristics about the corresponding data, while the data extension segments are intended primarily to provide a vehicle for adding support for new types of data. The "tags" for the tagged records will be coordinated centrally to avoid conflicting use.

3. Supported data types. A NSIF file supports the inclusion of three standard types of data segments in a single file: image, graphic, and text data segments. It is also possible to provide exact geolocation of image segments using standard mechanisms (see Annex D). Additional types of data may be included in a NSIF file by use of Data Extension Segments (DES) (see paragraph 26c(1)). Information of a standard data type is called a standard data segment. Information of a type defined in a DES is a data extension segment. The order of these major file components is illustrated on Figure C-1.

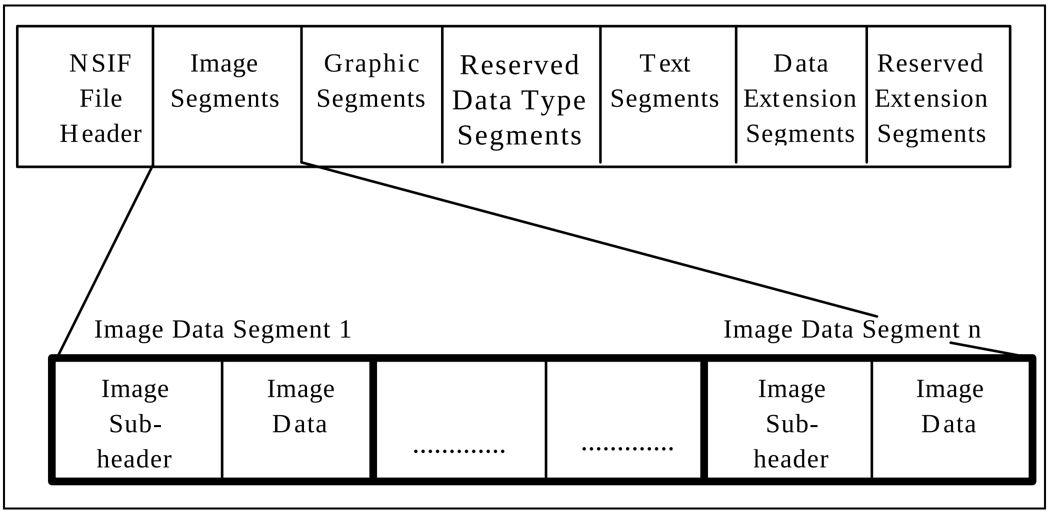


Figure C-1. NSIF file structure

4. Application guidance. The NSIF file supports inclusion of standard data types of information in a single file: image, graphic, and text. It is possible to include zero, one, or multiples of each standard data type in a single file (for example: several images, but no graphics). Standard data types shall be placed in the file in the following order: all image segments, followed by all graphic segments, followed by all text segments (documents).

5. Standard data segment subheaders. Each individual, standard data segment included in a NSIF file, such as an image or a graphic data segment, shall be preceded by a "subheader" corresponding to that data segment. This subheader shall contain details of that particular data item and data type only. If no items of a given type are included in the file, a subheader for that data type shall not be included in the file. All data items and associated subheaders of a single type shall precede the first subheader for the next data type. The ordering of multiple data items of one type is arbitrary. A diagram of the overall NSIF file structure is shown on Figure C-1.

6. Header/Subheader field specification. The specification of the fields in the various headers/subheaders found within a NSIF file is provided in a series of tables in Appendix 1. Each table includes a mnemonic identifier for each field within a header/subheader, the FIELD's name, a description of the valid contents of the field, and any constraints on the field's use, the field SIZE in bytes, the VALUE RANGE it may contain, and an indication of its "TYPE" (see paragraph 8). The NSIF file header fields are specified in Table C-1-1. The standard data type segment subheader fields are specified in Tables C-1-3, C-1-3(A), C-1-5, and C-1-6. The tagged record extension subheaders (see paragraph 26 and paragraph 26a) and RES are defined in tables C-1-7 and C-1-9. Finally, the data extension segment subheader fields (see paragraph 26c(1)) are defined in Table C-1-8. The data that appears in all header/subheader information fields specified in the tables, including numbers, shall be represented using the printable BCS character set (defined in Table C-3-1 of Appendix 3) with eight bits (one byte) per character. Representing numbers in character form avoids many of the problems associated with differences in word length and internal representation among different machines. Representing the header and subheader fields in BCS also makes them more easily read by humans. All field size specifications given for the header and subheader fields specify a number of bytes. Fields that may contain any printable BCS characters (including punctuation marks) are indicated as "Alphanumeric" in the VALUE RANGE specification.

7. Field structure and default values. The NSIF uses character counts to delimit header fields, as opposed to special end-of-field characters or codes or direct addressing. These counts are provided in the tables detailing the NSIF header and subheader field specifications. All data in fields designated "BCS-A" shall be left justified and padded to the right boundary with BCS spaces. All data in numeric fields (BCS-N) shall be right justified and padded to the left boundary with leading zeros. The standard default value shall be BCS spaces for alphanumeric fields and zero for numeric fields. For a few fields, a specific default may be indicated in the field description. In this case, the field description shall take precedence. All header and subheader fields contained in a NSIF file shall contain either valid data (that is, data in accordance with the restrictions specified for the contents of the field in this document) or the specified default value.

8. Field types. The NSIF file header and various subheaders have two types of fields: required and conditional. A required field shall be present and shall contain valid dataor the specified default value. A conditional field may or may not be present depending on the value of one or more preceding (required) fields. If a conditional field is present, it shall contain valid data. When a field is conditional, its description identifies what conditions and which preceding field or fields are used to determine whether or not to include it in the file. For example, in the NSIF file header, if the Number of Images (NUMI) field contains the value of 2, the fields LISH001, LI001, LISH002, and LI002 will be present and must be filled with valid data. However, if the NUMI field contains a zero, the subheader length and image length fields are omitted.

9. Logical recording formats.

a. Bit and byte order.

(1) The method of recording numeric data on interchange media shall adhere to the “big endian” convention. In big endian format, the most significant byte in each numeric field shall be recorded and read first, and successive byte recorded and read in order of decreasing significance. That is, if an n-byte field F is stored in memory beginning at address A, then the most significant byte of F shall be stored at A, the next at A+1, and so on. The least significant byte shall be stored at address A+n-1.

(2) BCS character strings shall be recorded in the order in which the data is generated.

(3) The most significant bit in each byte of every field, regardless of data type, shall be recorded and read first, and successive bits shall be recorded and read in order of decreasing significance.

(4) Pixel arrays shall be recorded in the order specified in the field IMODE and as discussed in paragraph 18c. Pixel arrays shall be recorded from left to right starting at the top, and non-interlaced raster scanning downward. The top left pixel shall be recorded first, and the bottom right pixel shall be recorded last.

b. Row column relationship. NSIF imagery is displayed by mapping each image pixel to a specific row “r” and column “c” within the bottom right quadrant shown on Figure C-2. Rows are represented on the vertical (y-axis) and columns are represented on the horizontal (x-axis). Moving from location 0,0 down and to the right is considered moving in a positive direction. The first pixel of an image would be placed at r0,c0, followed by pixels r0,c1; r0,c2 and so on until the end of the row. The first pixel of the second row of image pixels would be located at r1,c0.

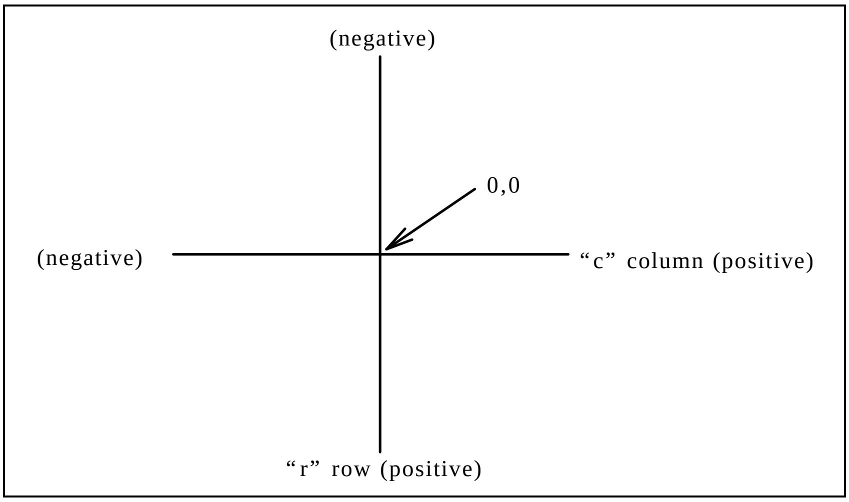


Figure C-2. Row column relationship

THE NSIF FILE HEADER

10. General. Each NSIF file shall begin with a header, the file header, whose fields contain identification and origination information, file-level security information, and the number and size of information items of each type, e.g. image segment(s), graphics segment(s), and text segment(s), contained in the file. Figure C-3 depicts the NSIF file header. It depicts the types of information contained in the header and shows the header’s organisation as a sequence of groups of related fields. The expansion of the "Image Group" illustrates how the header's overall length and content may expand or contract depending on the number of data segments of each type included in the file. The Custodian is detailed in Table C-1-1.

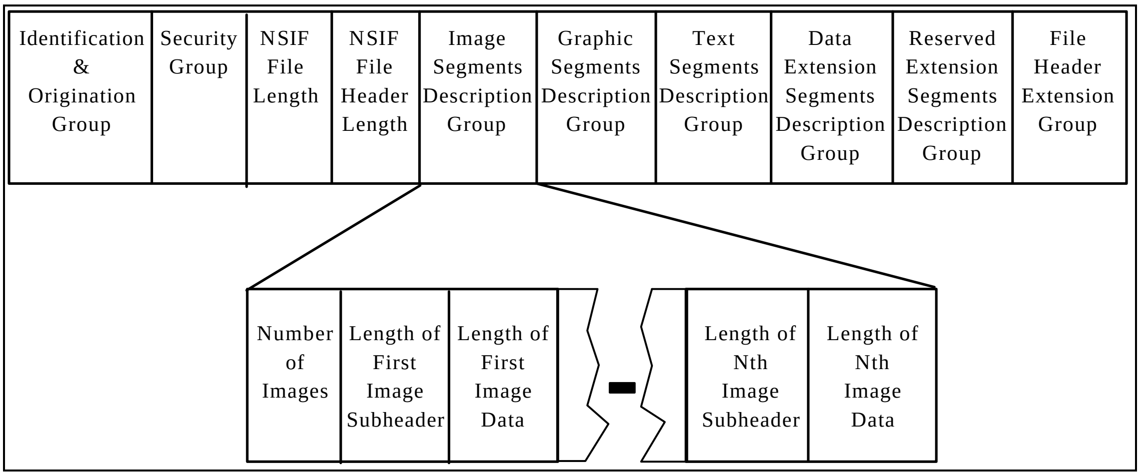


Figure C-3. NSIF file header structure

NSIF PRODUCT AND OVERLAY CONCEPT

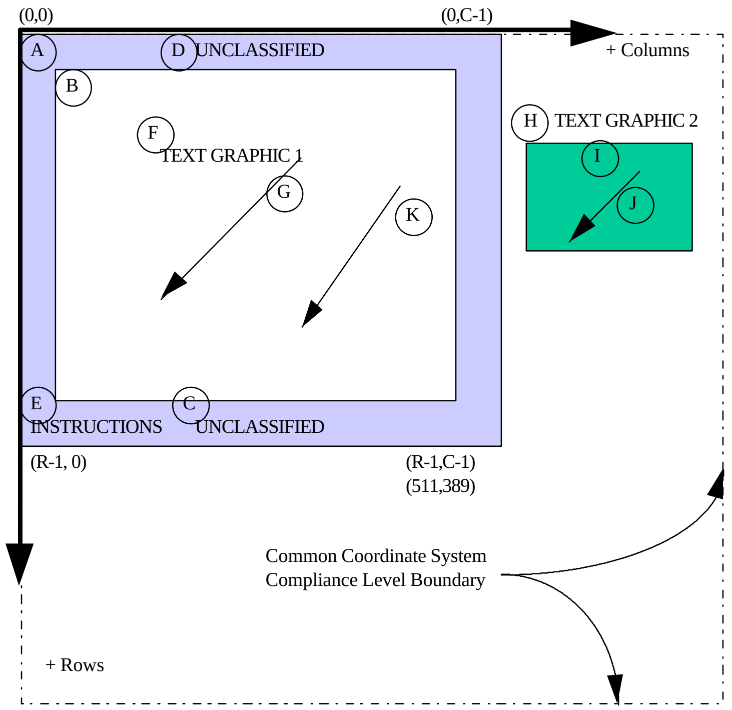
11. General. The following subsections describe the non-destructive nature of NSIF and the relationships anticipated to exist among the data segments in a NSIF file and how these relationships are represented in the file. An image product may conceivably consist of the following: a correlated set of multiple NSIF files; a single NSIF file with multiple images, each with their own overlays and associated data; a NSIF file with no image; and/or a single NSIF file with a single image and its overlays and associated data. To facilitate description of the NSIF overlay concept, only the latter case will be addressed in the context of this subsection. See Appendix 5 to Annex C for applying the overlay concept to the other two cases.

12. Image overlay relationships. Each single file image product is comprised of one or more NSIF standard information data segments plus associated data. The association and portrayal of displayable segments is accomplished through the use of location indices, display levels, and attachment levels. The placement of displayable data segments in the common coordinate system (see Annex B, paragraph 8) is recorded in the location field of the segment’s subheader. The relative visibility, when displayed, of the various displayable segments in the file is recorded in the file by use of the display level (the "DLVL" field in the standard information type subheaders, specifically IDLVL for images and SDLVL for graphics). Groupings of related segments may be formed by use of the attachment level (the “ALVL” field in the standard

information type subheaders, specifically IALVL for images and SALVL for graphics). For example, when a base image segment is present, it may form the basis for using the other data contained in the product. Images other than the base image may be associated with the base image via the use of the ILOC, IDLVL and IALVL fields of their image subheaders. All images and graphics associated with the base image define overlays to the base image in the sense that, when displayed, they will overwrite the underlying portion (if any) of the base image. Images and graphics associated with (attached to) the base image may be positioned such that they are completely on the base image, are partially on the base image, or completely off (adjacent to) the base image.

13. Overlays and display level. The order in which images and graphics are "stacked" visually when displayed is determined by their display level (the DLVL field in the standard information type subheaders, specifically IDLVL for images and SDLVL for graphics), not by their relative position within the NSIF file. The display level is a positive integer less than 1000. Every image and graphic segment in a NSIF file shall have a unique display level. That is, no two segments may have the same display level. This requirement allows display appearance to be independent of data processing or file sequence order.

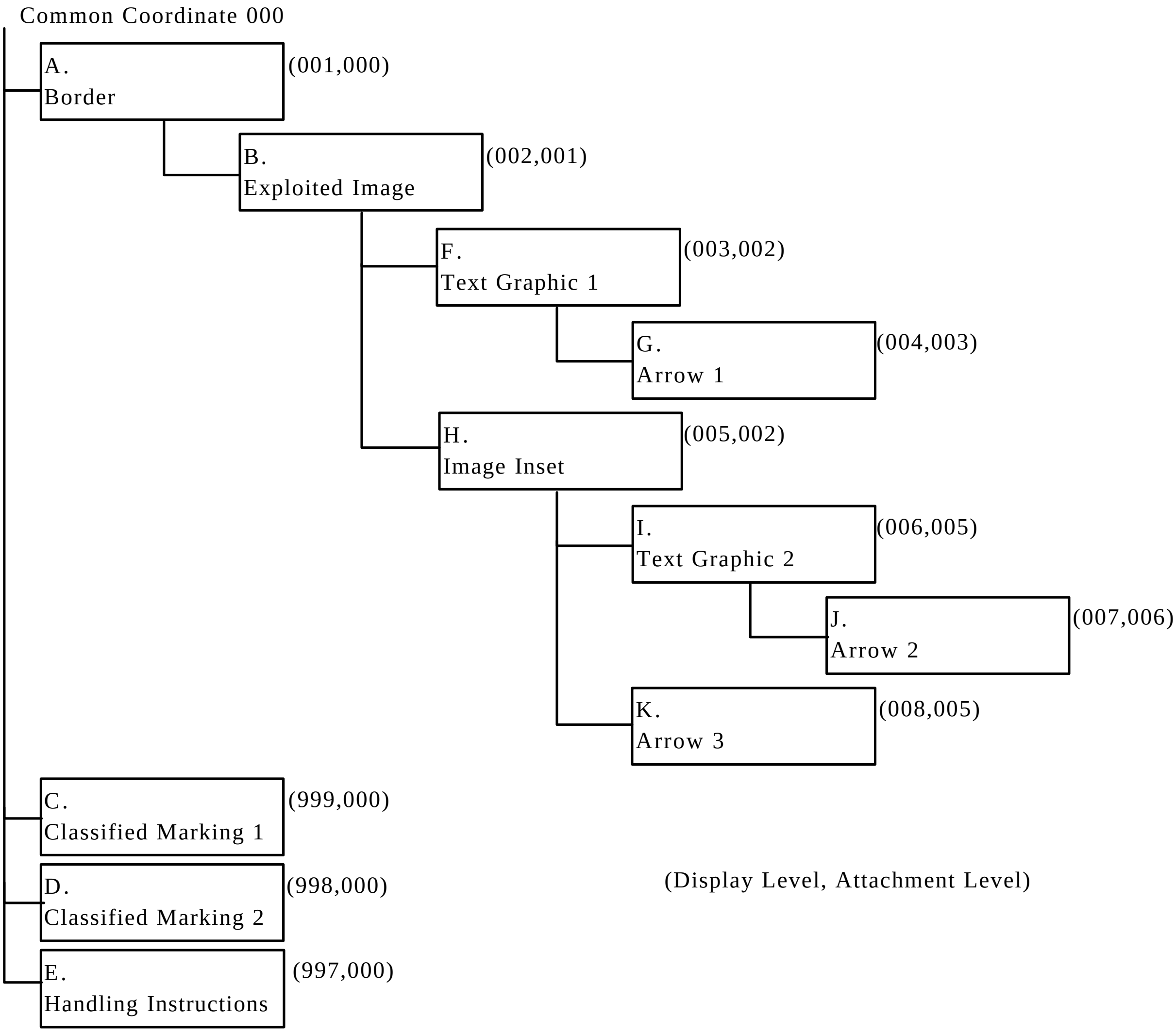
14. Display level interpretation. The display level determines the display precedence of images and graphics within an NSIF file when they are output to a display device. That is, at any pixel location shared by more than one image or graphic, the value displayed there is that determined from the segment with the highest numbered display level. Figure C-4 illustrates a sample "output presentation" from a NSIF file that illustrates the effects of display level assignment. The Display Level (DL) of each segment shown on Figure C-4 is indicated in the list of items on Figure C-4. In the case shown, the segment with display level one is not an image but rather an opaque CGM rectangle (graphic data, not image data). Because the CGM rectangle is larger than the image (which, in this case, serves as the first overlay because its display level is two), it provides a border to the base image. Following increasing DL value, the border is overlaid by the image which, in turn, is overlaid by arrow one, which is in turn overlaid by the image inset, etc. The AL values in Figure C-4 refer to "Attachment Levels."



	Location Offsets			
	DL	AL	Row	Column
A. Border (Opaque Box)	001	000	00000	00000
B. Exploited Image	002	001	00025	00025
C. Classified Marking 1	999	000	00370	00256
D. Classified Marking 2	998	000	00015	00256
E. Handling Instructions	997	000	00370	00040
F. Text Graphic 1	003	002	00060	00240
G. Arrow 1	004	003	00010	00040
H. Image Inset	005	002	00045	00525
I. Text Graphic 2	006	005	00020	00050
J. Arrow 2	007	006	00010	00050
K. Arrow 3	008	005	00070	-0005

Figure C-4. NSIF display level illustration

15. Attachment level. Attachment level (AL) provides a way to associate display segments (images and graphics) with one another so they may be treated together for certain operations such as moving them, rotating them, or displaying them as a group. The attachment level of a displayable segment shall be equal to the display level of the segment to which it is "attached." This value is stored in the "ALVL" field (specifically IALVL for images, SALVL for graphics) of the segment's subheader. A segment with Display Level 1 (DL001) (the minimum display level in this example), must have an attachment level of zero. An attachment level of zero shall be interpreted as "unattached." The segment having minimum display level shall have attachment level zero and location (0,0). Any other segment may also have AL zero, that is, be unattached. An overlay's display level shall always be numerically greater than its attachment level (that is, an overlay must be attached to something previously displayed or it is unattached). Figure C-5 shows the attachment relationships of the overlays on Figure C-4. When an overlay or base is edited (moved, deleted, rotated), all overlays attached to it, directly or indirectly, may be affected by the same operation. For example, on Figure C-5, if the exploited image (DL 002, AL 001) were moved one centimetre to the left, the arrows (DL 004, AL 003, and DL 008, AL 006), the image inset (DL 005, AL 002)(DL 007, AL 006), and the graphic (DL 006, AL 005) associated with the image inset also would be moved one centimetre to the left. Recognising that because of the way the attachments have been constructed, if the graphic label (DL 003, AL 002) were deleted, so would be its associated arrow 2 (DL007, AL 006). However, if the image inset (DL 005, AL 002) were deleted, its associated arrow 1 (DL 004, AL 003) would not be deleted. Although the attachment level provides the means to group or associate display items, the provision of user operations (e.g. moving, rotating, etc.) to act on or use attachment level information is an implementor’s choice.



A is a parent object and has a single child B and 7 offspring, F, G, H, I, J, and K.
B is a parent object and has 2 children F and H and 5 offspring, F, G, H, I, J, and K.
C is childless
D is childless
E is childless
F is a parent object and has a single child G.
G is childless
H is a parent object and has 2 children I and K
I is a parent object and has a single child J
J is childless
K is childless

Figure C-5. Attachment level relationships

IMAGE DATA

16. General. For the NSIF, the imagedata encompasses multispectral imagery and images intended to be displayed as monochrome (shades of grey), colour-mapped(pseudocolour), or true colour and may include grid or matrix data intended to provide additional geographic or geo-referencing information.

a. Image category (ICAT). The specific category of an image item reveals its intended use or the nature of its collector. The possible use of standard support data extensions to provide geo-referencing data depends on both the intended use of the transmitted data item and on its nature as described in Table C-1-2.

b. Image representation (IREP). An image may include multiple data bands and colour look-up tables (LUTs), the latter within its header fields. True colour images (three band) may be specified to be interpreted using either the RGB

(Red, Green, Blue) or the YCbCr (Y = Brightness of signal, Cb = Chrominance (blue), Cr = Chrominance (red)) colour system. Grids or matrix data may include one, two or several bands of attribute values intended to provide additional geographic or geo-referencing information. The image representation must be consistent with the image category as shown in Table C-1-2.

17. Image model. For the NSIF, an image is a two-dimensional rectangular array of pixels indexed by row and column. A pixel is represented by an n-vector of sample values, where n corresponds to the number of bands comprising the image. The i^{th} entry of the pixel (vector) is the pixel value for the i^{th} band sample of the image. Therefore, the i^{th} band of the image is the rectangular array of i^{th} sample values from the pixel vectors. For an image I with R rows and C columns, the coordinates of the image pixel located in the c^{th} column of the r^{th} row shall be denoted by an ordered pair (r,c), $0 \leq r < R, 0 \leq c < C$, where the first number, r, indicates the row and the second number, c, indicates the column in the image array. This notation is standard for addressing arrays and matrices. The pixel located at (r,c) is denoted by I(r,c). For example, a typical 24-bit RGB image is an array of R rows and C columns, where each indices (r,c), $0 \leq r < R, 0 \leq c < C$, identifies a pixel I(r,c) consisting of three single byte values (a three-vector) corresponding to the red, green, and blue samples. The image has three bands, each consisting of a R-by-C array of single byte sample values. One band comprises all the red, one band comprises all the green, and the third band comprises all the blue pixel sample values. Specifically, the value at position r,c in the green band, for example, contains the green byte from the pixel I(r,c) three-vector at position r,c in the image.

a. Display of NSIF images. When an image with R rows and C columns is displayed, a mapping is accomplished from the stored image pixel value array I to a rectangular array S of physical picture elements, for example a Cathode Ray Tube (CRT) display. This mapping will be called the display mapping. Usually, the resulting display has an identified top, bottom, and left and right side. In a particular application, the display mapping may be defined explicitly. However, lacking this, an image stored in a NSIF file shall be interpreted so that pixel I(0,0) is at the upper left corner, and pixel I(R-1,C-1) is at the lower right corner. The r^{th} row of the image array I shall form the r^{th} row of the display, counting from the top, 0#r<R. Within the r^{th} row, the pixels shall appear beginning on the left with I(r,0) and proceeding from left to right with I(r,1), I(r,2), and so on, ending with I(r, C-1). Figure C-6 illustrates the display mapping just described. This mapping of pixel values to physical picture elements is typical of non-interleaved raster pattern of picture elements. The relationship of the pixels I(r,c) in the image array to up, down, left and right implicit in this diagram is used freely in later descriptions to simplify exposition.

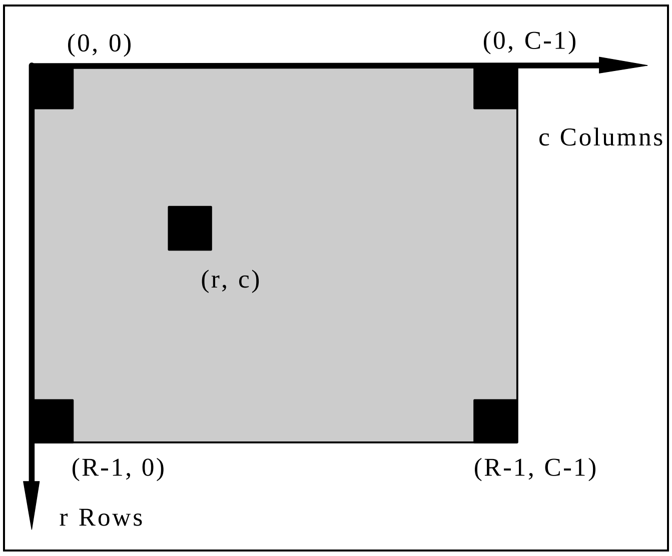


Figure C-6. Image coordinate system

b. Blocked images. The concept blocked images, extends the image model for NSIF presented above to support the representation of an image in terms of an orderly set of subimages (or subarrays) called blocks. For large images (e.g. those having more horizontal and vertical pixel values than typical display devices), the performance of an imagery implementation can be potentially improved by "blocking" the image; that is, ordering the pixel values in the NSIF file as a series of concatenated pixel arrays.

(1) The idea behind a blocked image is analogous to a rectangular tiled floor. Regard the overall floor cover as the image and each individual tile as a block. To make this more precise, let I be an image of R rows and C columns, and let the Number of Pixels Per Block Horizontal (NPPBH), (that is, the number of columns of each block) and the Number of Pixels Per Block Vertical (NPPBV), (that is, the number of rows in each block) be positive integers that satisfy NPPBH≤C and NPPBV≤R. If R is an integral multiple of NPPBV and C is an integral multiple of NPPBH, then I may be viewed as an array B of subarrays each having

NPPBV rows and NPPBH columns. These subarrays $B_{r,c}$ are called blocks. The block $B_{r,c}$ is in the r^{th} row of blocks and the c^{th} column of blocks. The number of columns of blocks (number of blocks per row, NBPR) is the integer [C/NPPBH]+1 and [C/NPPBH] if [C/NPPBH]=C/NPPBH, and the number of rows of blocks (number or blocks per column, NBPC) is the integer [R/NPPBV]+1 and [R/NPPBV], if [R/NPPBV]=R/NPPBV ([r]:=largest integer ≤ r).

(2) For recording purposes, the image blocks are ordered and indexed sequentially by rows, i.e. B(1,1) … B(1, NBPR); B(2,1) … B(2,NBPR); B(NBPC,1)… B(NBPC,NBPR). The relation of image blocks to image rows and columns is depicted on Figure C-7(a) using the NSIF display convention described in paragraph 17a. Although the pixel values are placed in the file as a series of arrays (blocks), the coordinate used to reference any specific pixel remains the same as if the image were not blocked. For example, if R=C=2048 and NPPBV=NPPBH=1024, there will be four blocks in the image I. The second pixel value in B(1,2) has the coordinate I (0,1025) vice the internal index (0,1) of the subarray.

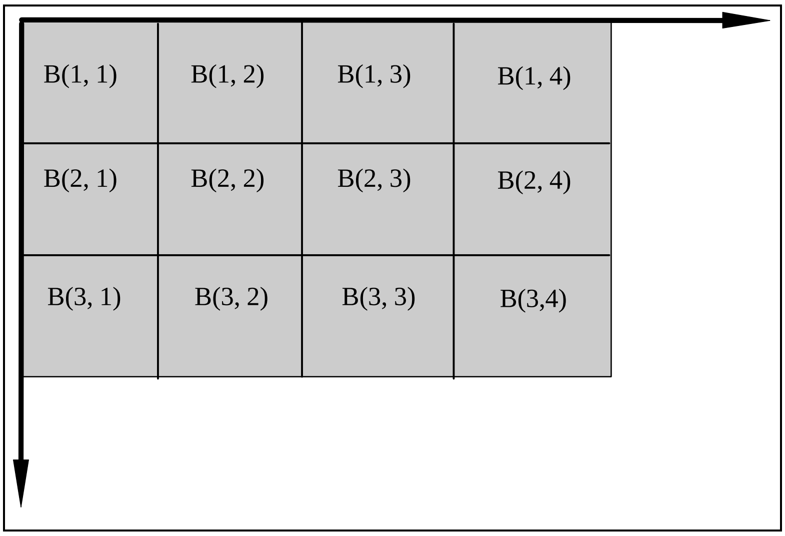


Figure C-7(a). A blocked image

(3) If the number of rows in an image is not initially an integer multiple of NPPBV, or if the number of columns is not an integer multiple of NPPBH, an application that creates the blocked image construct in NSIF shall "pad" the image to an appropriate number of rows and columns so the divisibility condition is met by adding rows to the bottom and/or columns to the right side of the image, as viewed in Figure C-7(b). The result is that a blocked image may have a block(s) (subarray(s)) comprised of pixel values from the original image and “pad” pixels inserted to meet block boundary conditions.

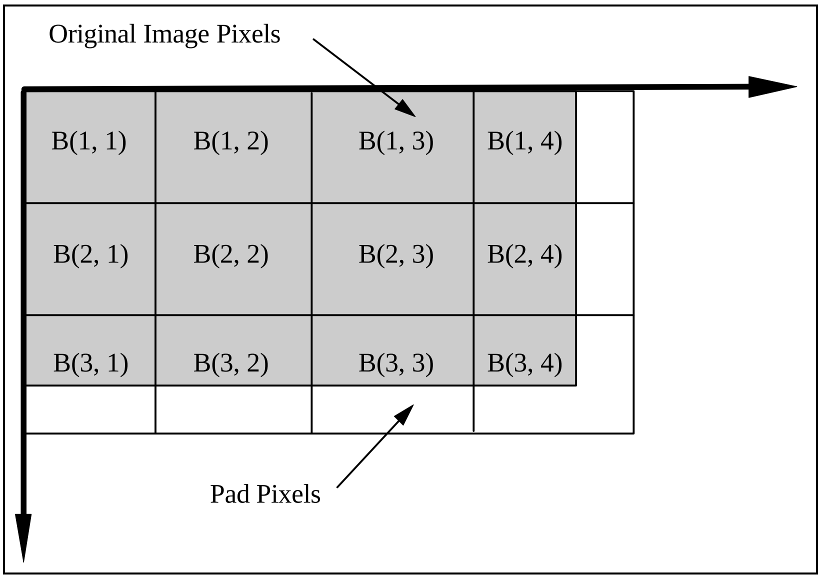


Figure C-7(b). A blocked, padded image

c. Blocked image masking. In some instances, a blocked image may have a considerable number of empty blocks (blocks without meaningful pixel values). This might occur when a rectangular image is not north aligned when scanned or otherwise sampled, but has been rotated to a north up orientation (see Figure C-7(c)) resulting in the need to insert "pad" pixels to maintain the rectangular raster pattern of the pixel array. In this case, it is sometimes useful to not record or transmit empty blocks within a NSIF file. However, if empty blocks are not recorded/transmitted, the image loses its logical structure as an image with n x m blocks. In order to retain logical structure, and to allow the exclusion of empty blocks, an image data mask table identifies the location of non-empty blocks so that the using application can reconstruct the image correctly. In Figure C-7(c), the recording order would be B(1,1); B(1,2); B(1,3); B(2,1); B(2,2); B(2,3); B(2,4); B(3,1); B(3,2); B(3,3); B(3,4); B(4,2); B(4,3); B(4,4). Blocks B(1,4) and B(4,1) would not be recorded in the file. The blocked image mask would identify the locations of the recorded image blocks. If the image is band sequential (IMODE=S), there will be multiple block image masks (one for each image band), with each mask containing NBPR (Number of Blocks Per Row) * NBPC (Number of Blocks Per Column) records. Blocked image masks can be used in conjunction with a pad pixel mask, as described below. A blocked image mask may also be used to provide an index for random access within the blocked image data for large images, even if all blocks are recorded in the file.

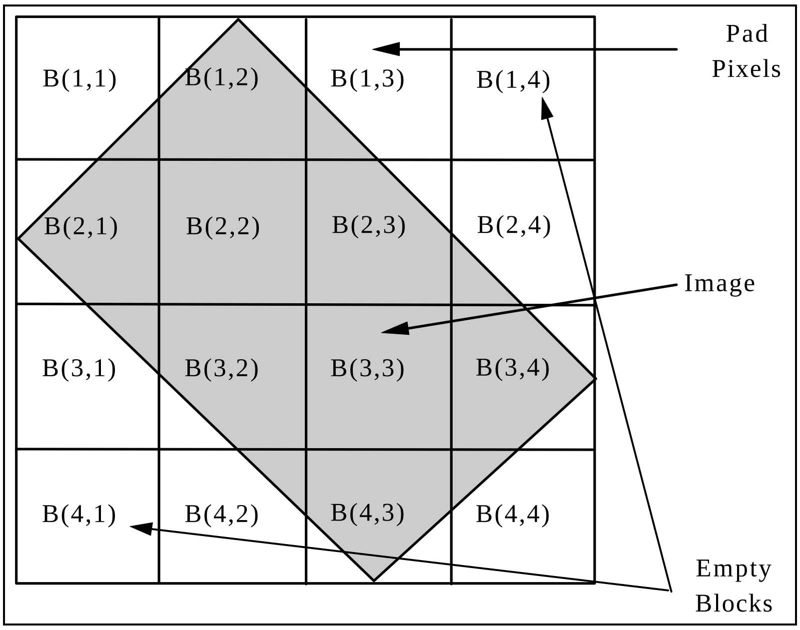


Figure C-7(c). A blocked, padded image with empty blocks

d. Pad pixel masking. In addition to empty image blocks, Figure C-7(c) also demonstrates that a significant number of pad pixels may be needed to "fill" an image to the nearest block boundary.

(1) In the example in Figure C-7(c), the locations of image B(1,1); B(1,2); B(1,3); B(2,1); B(2,3); B(2,4); B(3,1); B(3,2); B(3,4); B(4,2); B(4,3); and B(4,4) would be recorded indicating that those blocks have pad pixels. B(1,4); B(2,2); B(3,3), and B(4,1) do not have pad pixels because B(1,4) and B(4,1) are empty and B(2,2) and B(3,3) are full image blocks.

(2) If the image is band sequential (IMODE=S), there will be pixel masks that will be arranged in the same order as the image bands, with each mask containing Number of Blocks Per Row (NBPR) * Number of Blocks Per Column (NBPC) records.

(3) The output pixel code which represents pad pixels is identified within the image data mask by the Output Pixel Code field (TPXCD). The length in bits of this code is identified in the Output Pixel Code Length field (TPXCDLNTH). Although this length is given in bits, the actual TPXCD value is stored in an integral number of bytes. When the number of bits used by the code is less than the number available in the TPXCD field (for example, a 12 bit code stored in two bytes), then the code will be justified in accordance with the PJUST field in the Image Subheader.

(4) When an application identifies pad pixel values, it may replace them with a user defined value (for example, a light blue background) at the time of presentation except when the value of TPXCD is zero (0). When the TPXCD value is zero, the pad pixel will be treated as “Transparent” for presentation. The application may choose to ignore pad pixels in histogram generation. In any case, pad pixels are not valid data, and should not be used for interpretation or exploitation. Consequently, the value used for pad pixels shall not appear within the bounds of significant pixels of the image.

18. NSIF image information fields. In the NSIF, the information describing an image is represented in a series of adjacent fields grouped into the image subheader followed by the image data. The field containing the image data is called the image data field. The image data field shall follow immediately the last field of the corresponding image subheader with no intervening special characters to designate the beginning of the image data field. Similarly, the image subheader of the first image shall follow immediately the last byte of data of the last field in the Custodian, and the image subheader of successive images shall follow immediately the last byte of the image data field of the preceding image.

a. Image subheader fields. The data in the image subheader fields are BCS character data (except for LUTs). They provide information about the image source, its identification, and characteristics needed to display and interpret it properly. The image subheader field definitions are detailed in Table C-1-3.

b. Image data mask table. The image data mask table is a conditional data structure included in the image data stream for masked images when so indicated by the Image Compression field value (IC values NM, M1, M3, M4 and M5). The image data mask table is not recorded for non-masked images (IC values NC, C1, C3, C4 and C5). The image data field of a masked image is identical to that of non-masked images except for the following: the first byte of the image data is offset from the beginning of the image data field by the length of the image data mask table(s); and empty image blocks are not recorded/transmitted in the image data area. If the image is band sequential (IMODE=S), there will be multiple blocked image and/or pad pixel masks (one for each band). All blocked image masks will be recorded first, followed by all pad pixel masks. Since the image data mask tables are in the image data area, the data recorded/transmitted there are binary. The structure of the image data mask table is defined in detail in Table C-1-3(A).

c. Image data format. Image data may be stored in a NSIF file in either uncompressed or compressed form.

(1) Uncompressed image data format. The order in which pixel values of a single band image are stored is fixed. When an image has more than one band, several options are available for the order in which pixel values are stored. The option used is indicated by the IMODE field in the

image subheader. The following subparagraphs describe the possibilities within this format. In describing the encoding of image data, the NSIF display convention is invoked freely for ease of expression. Let the image to be encoded be denoted by I, and assume I has R rows and C columns. Let I have n bands; that is, each pixel is an n-vector, the i^{th} value of which is the value for that pixel location of the i^{th} band of the image. Let N denote the number of bits-per-pixel-per-band. Thus, there are $n * N$ bits-per-pixel. Let I be blocked with H blocks per row and V blocks per column. Note that special cases such as single band images and single block images are included in this general image by setting n=1, and H=V=1, respectively.

(a) Single band image uncompressed data format. For single band images, n=1, and there is only one order for storing pixels. The field IMODE in the image subheader shall be set to B for this case. The blocks (one or more) shall be stored, one after the other starting with the upper left block and proceeding first left to right across rows of blocks, one row of blocks after the other, top to bottom. Image data within each block shall be encoded as one continuous bit stream, one pixel value after another, beginning with the N bits of the upper left corner pixel, I(0,0), followed by the N bits of I(0,1) and so on until all pixels from the first row in the block are encoded. These shall be followed immediately by the N bits of data for pixel I(1,0) continuing from left to right along each row, one row after another from the top of the block to the bottom. The last byte of each block's data is zero-filled to the next byte boundary, but all other byte boundaries within the block are ignored. See the field Pixel Value Type (PVTYPE) description in Table C-1-3 for the specification of the bit representation of pixel values.

(b) Multiple band image uncompressed data format. For multiple band images, there are three orders for storing pixels.

{1} Band sequential. The first case is "band sequential", in which each band is stored contiguously, starting with the first band, one after the other, until the last band is stored. Within each band the data shall be encoded as if it were a single band image with one or more blocks (see paragraph 18c(1)(a)). The field IMODE in the image subheader shall be set to S for this case. This case is only valid for images with multiple blocks and multiple bands. (For single block images, this case collapses to the “band interleaved by block” case where IMODE is set to B.)

{2} Band interleaved by pixel. The ordering mechanism for this case stores the pixels in a block sequential order in which each block is stored contiguously, starting with the upper left block and proceeding first left to right across rows of blocks, one row of blocks after the other, top to bottom. For "band interleaved by pixel" the $n * N$ bits of the entire pixel vector are stored pixel-by-pixel in the same left to right, top to bottom pixel order as described in paragraph 18c(1)(a). The $n * N$ bits for a single pixel are stored successively in this order: the N bits of the first band followed by the N bits of the second band and, so forth, ending with the N bits of the last band. Each block shall be zero-filled to the byte boundary. The field IMODE in the image subheader shall be set to P for this storage option. See the field Pixel Value Type (PVTYPE) description in Table C-1-3 for the specification of the bit representation of pixel values for each band.

{3} Band interleaved by block. The ordering mechanism for this case stores the pixels in a block sequential order where each block is stored contiguously, starting with upper left block and proceeding first left to right across rows of blocks, one row of blocks after the other, top to bottom. For "band interleaved by block" the data from each block is stored starting with the first band, one after the other until the last band is stored. Each block shall be zero-filled to the next byte boundary. The field IMODE in the image subheader shall be set to B for this storage option. See the field Pixel Value Type (PVTYPE) description in Table C-1-3 for the specification of the bit representation of pixel values for each band.

(2) Compressed image data format. The format of the image data after compression is provided with the description of the NSIF image compression algorithms in ITU-T RECMN T.4 AMD2, ISO/IEC 10918-1, ISO/IEC DIS 10918-3, and MIL-STD-188-199. Also found in these references are the conditions the data must meet before a given compression method can be applied meaningfully.

d. Grey scale look-up tables (LUT). The grey scale to be used in displaying each pixel of a grey scale image is determined using the image's LUT, if present. A LUT for a grey scale image, when present, shall comprise a one byte entry for each integer (the entry's index) in the range 0 to NELUTnn-1. The bytes of the LUT shall appear in the file one after the other without separation. The entries shall occur in the index order, the first entry corresponding to index 0, the second to index 1 and so on, the last corresponding to index NELUTnn-1. The display shade for a pixel in the image shall be determined by using the image pixel value as an index into the LUT. The LUT value shall correspond to the display grey shade in a way specific to the display device. NELUTnn shall be equal to or greater than the maximum pixel value in the image to ensure that all image pixels are mapped to the display device.

e. Colour look-up tables (LUT). Colour images are represented using the RGB colour system notation. For colour images, each LUT entry shall be composed of the output colour components red, green, and blue, appearing in the file in that order. There shall be a LUT entry for each pixel value in a particular band of a NSIF image (the entries index of the LUT will range from 0 to 2^{NBPP}-1). The LUT entries shall appear in the file in increasing index order beginning with index 0. The display colour of an image pixel shall be determined by using the pixel value as an index into each LUT (red, green, blue). The corresponding values for red, green, and blue shall determine the displayed colour in a manner specific to the display device. The presence of colour LUTs is optional for 24-bit per pixel (true colour) images. Pseudo-colour (e.g. 8-bit per pixel colour images) shall contain a LUT to correlate each pixel value with a designated true colour value. Pixels larger than 16 bits may not be mapped with a NSIF LUT and NSIF LUT values can be no larger than 8 bits.

GRAPHIC DATA TYPE

19. General. Graphic data is used in the NSIF to store two-dimensional information represented as a Computer Graphics Metafile (CGM). Each graphic segment consists of a graphic subheader and data. A graphic may be black and white, grey scale, or colour. Examples of graphics are circles, ellipses, rectangles, arrows, lines, triangles, logos, unit designators, object designators (ships, aircraft), text, and special characters. A graphic is stored as a distinct unit in the NSIF file allowing it to be manipulated and displayed non-destructively relative to the images, and other graphics in the file. This STANAG does not preclude the use of n-dimensional graphics when future standards are developed.

20. Graphic subheader. The graphic subheader is used to identify and supply the information necessary to display the graphic data as intended by the file builder. The format for a graphic subheader is detailed in Table C-1-5.

21. Graphic data format. The graphic format is CGM as described in ISO/IEC 8632-1. The precise tailoring of the CGM standard to NSIF is found in MIL-STD-2301.

TEXT DATA

22. General. Text data shall be used to store a textual based file or an item of text, such as a word processing file or document. Text is intended to convey information about the image product contained in the NSIF file.

23. Representation of textual information. The NSIF uses two different categories of textual character representations: text only and mark-up text (e.g. word processor formatted text). Each category has a set of lexical levels which constrain the use of characters within the category. The three lexical levels are: BCS, BCS-E, and UCS

a. Basic Character Set. The Basic Character Set restricts the allowable characters to a relatively small set that can be represented in 8-bit per character codes. This character set is selected from ISO/IEC 10646-1, but uses only the 'Cell-octet' of the basic coding structure described in ISO/IEC 10646-1. The BCS uses only the 'Cell-octet' of the two-octet Basic Multilingual Plane form, implementation level 1, of ISO/IEC 10646-1. The range of allowable characters for BCS-A consists of the following: (all printable 7-bit characters plus)

Line feed	code 0x0A
Form feed	code 0x0C
Carriage Return	code 0x0D
Space through Tilde	codes 0x20 through 0x7E (BMP block 'BASIC LATIN')

b. Basic Character Set - Extended (BCS-E). The BCS-E extends the BCS set of character codes to include codes 0x80 through 0xFF of the BMP block BASIC LATIN, all printable 8-bit characters plus LF, FF, and CR.

c. Universal Multiple Octet Coded Character Set (UCS). The UCS is used for expressing text in many languages of the world as defined by ISO/IEC 10646-1. The specific character set selected from UCS shall be identified by profile. The profile shall identify the adopted form, the adopted implementation level and the adopted subset (list of collections and/or characters) in accordance with the structures defined in ISO/IEC 10646-1. When a profile defined UCS is used in a NSIF file, the coding shall contain an explicit declaration of identification of features (escape sequence) as specified in ISO/IEC 10646-1. When no declaration escape sequence is included, the default shall be that defined for BCS above.

24. Text data subheader. The text subheader is used to identify and supply the information about the text file necessary to read and display the text data. The text subheader is detailed in Table C-1-6.

FUTURE EXPANSION

25. General. Future expansion of the NSIF is supported in two ways: (1) built-in mechanisms and procedures to allow inclusion of user-determined and user-defined data characteristics and types of data without changing this standard (but configuration managed through the Custodian), and (2) a collection of data fields called Data Extension Segments and Reserved Extension Segments providing space within the file structure for adding entirely unspecified future capabilities to this standard. Addition of further data characteristics beyond those specified in this standard is accomplished using the User Defined Data (UDHD and UDID), Extended Header Data (XHD), and Extended Subheader Data (IXSHD, SXSHD, and TXSHD) fields. Use of these fields is described in paragraph 26a and paragraph 26b. Addition of new types of data items is accomplished using Data Extension Segments defined in paragraph 26c(1). Extensions of all types may be incorporated into the file while maintaining backward compatibility, since the byte count mechanisms provided allow applications developed prior to the addition of newly defined data, to skip over extension fields they are not designed to interpret.

26. Tagged record extensions. Variations of the same basic extension mechanism, tagged records, are used for all extensions except the Reserved Extension Segments, which will be discussed separately. There are three varieties of tagged record extensions: registered extensions, controlled extensions, and encapsulated extensions. Figure C-8 illustrates the concepts and formatting descriptions in paragraph 26a through paragraph 26c. The Custodian shall also be responsible for the registration and configuration management of all tagged record extensions.

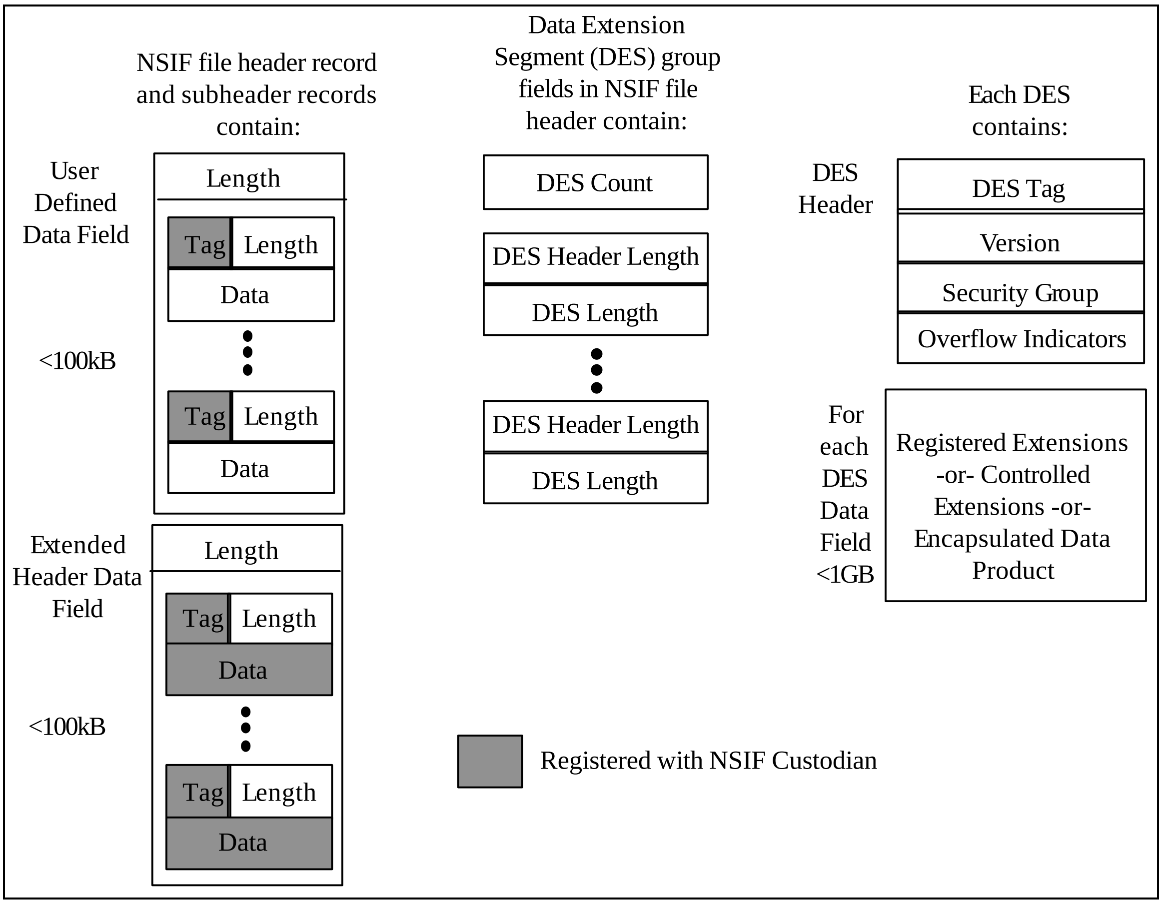


Figure C-8. Tagged record and Data Extension Segment formats

a. Registered extensions. Each registered tagged record extension consists of three required fields. These fields are defined in Table C-1-7. These extensions are user-defined. The six character RETAG field, the purpose of the tag and the overall structure of the REDATA field shall be registered with the designated registration/configuration authority. The purpose of registering the tags is to avoid having two users use the same tag to mean different extensions. A sequence of registered tagged record extensions can appear in the NSIF header User Defined Header Data field, UDHD, or any image subheader in its User Defined Image Data field, UDID. When the tagged record extension carries data associated with the file as a whole, it should appear in the UDHD field, if sufficient room is available. If the extension carries data associated with an image information item in the file, it should appear in the UDID field of that item's subheader, if sufficient room is available. A registered tagged record extension may appear in a Data Extension Segment (see paragraph 26c and subparagraphs) that is designated to contain registered tagged record extensions, but only if sufficient space is not available in the UDHD or a UDID, as appropriate. A registered tagged record extension shall be included in its entirety within the UDHD, a single UDID, or the single DES selected to contain it. A registered tagged record extension may not "overflow" record fields.

b. Controlled extensions. These extensions are defined and submitted to the designated registration/configuration authority for approval and once accepted are subject to configuration management by the Custodian. They are documented in a series of documents maintained by the Custodian. The tagged record format for controlled extensions is identical to that for registered extensions (detailed in Table C-1-7) except that the first two letters of each field identifier change from "RE" to "CE." The six character CETAG field and the structure of the CEDATA data field shall be registered and configuration controlled. A sequence of controlled tagged record extensions can appear in the XHD field of the NSIF file header or in the IXSHD, SXSHD, or TXSHD field of a standard information item in the file. When the controlled tagged record extension carries data that is associated with the file as a whole, it should appear in the XHD field, if sufficient room is available. If the extension carries data associated with a information item in the file, it should appear in the IXSHD, SXSHD, or TXSHD field of that item's subheader, if sufficient room is available. A controlled tagged record extension may appear in a Data Extension Segment (see paragraph 26c and subparagraphs), which is designated to contain controlled tagged record extensions, but only if appropriate. A controlled tagged record extension shall be included in its entirety within the XHD, a single IXSHD, SXSHD, or TXSHD or the single DES selected to contain it. A single controlled tagged record extension may not "overflow" file fields.

c. Encapsulated extensions. These extensions are similar to the controlled registered extensions in that each has a tag, and in this case, the tag versions are controlled through the standards amendment process. Each encapsulated extension shall appear in its own Data Extension Segment (DES) and shall conform to the DES structure

(1) DES structure. The NSIF header accommodates up to 999 DESs. Each DES shall consist of a DES subheader and a DES data field (similar to the way a standard information type item has a subheader and an adjacent associated data field). Within the Data Extension Segment Group in the NSIF Header is found the number of DES in the file, the length of each DES subheader, and the length of each DES data field, DESDATA. The field size specifications in the NSIF file header allow each DES to be just less than one gigabyte in length. The DES subheader is detailed in Table C-1-8. The structure provided in the DES by the fields DESSHL, DESSHF, and DESDATA is intended to encourage the formation of a DES along the lines of the standard information types in the NSIF, in which a group of BCS fields describing the data is followed by the data itself.

(2) Use of DES. The data in an encapsulated extension are anticipated to be defined typically by a specific version of a specific standard or product specification. Encapsulated extensions allow the incorporation of data products in a NSIF file to be disseminated along with an image. For example, Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), or other geo-referenced products could be distributed along with an image product to support analysis and interpretation of the image. Audio and video segments are additional examples of data that may be added to the NSIF through the use of Data Extension Segments.

(3) Reserved DES tags. There are two reserved tags: "Registered Extensions" and "Controlled Extensions." These tags are for use when a series of registered or controlled, tagged record extensions is to appear in a DES (see paragraph 26a and paragraph 26b) as "overflow" from the NSIF file header or any subheader. Which header or subheader overflowed is indicated in the DESOFLW and DESITEM field contents.

27. Reserved Extension Segments (RES) Structure is provided in the NSIF file header to support up to 999 distinct reserved extension segments of up to 9999999 bytes plus a corresponding subheader of up to 9999 bytes for each subheader extension. The combination of each subheader and corresponding data field is called a RES. These fields are reserved in that they shall not be present in any header until this standard is modified to define their use. However, upon receipt of a file that contains a RES(s) a NSIF compliant implementation shall at least ignore the RES(s) and properly interpret the other legal components of the NSIF file. See the definition of the field NUMRES, and the fields that follow it (LRESHmnn and LREnn) in Table C-1-1. The RES subheader is detailed in Table C-1-9.

APPENDIX 1 TO ANNEX C. NSIF TABLES

Table C-1-1. NSIF file header
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional
("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
FHDR	File Profile Name & Version A BCS character string of the form NSIFNN.NN which indicates this file is formatted using version NN.NN of NSIF. The valid values for this field is NSIF01.00.	9	NSIFNN.NN	R
CLEVEL	Complexity Level. This field shall contain the complexity level required to interpret fully all components of the file. Valid entries are integer assigned in accordance with complexity requirements established in Annex E..	2	BCS-N, 01-99	R
STYPE	Standard Type. Standard type or capability. A BCS character string of the form BF01 which indicates that this file is formatted using ISO/IEC 12087-5. NSIF01.00 is intended to be registered as a profile of ISO/IEC 12087-5.	4	BF01	R
OSTAID	Originating Station ID. This field shall contain the identification code of the originating organisation. It shall not be filled with BCS spaces (code 0x20).	10	BCS-A (non-blank)	R
FDT	File Date & Time. This field shall contain the time (UTC) of the file's origination in the format CCYYMMDDhhmmss, where CC is the first two digits of the year (00-99), YY is the last two digits of the year (00-99), MM is the month (01-12), DD is the day (01-31), hh is the hour (00-23), mm is the minute (00-59), and ss is the second (00-59). UTC (Zulu) is assumed to be the time zone designator to express the time of day.	14	CCYYMMDDhhmmss	R
FTITLE	File Title. This field shall contain the title of the file or shall be filled with BCS spaces (code 0x20).	80	BCS-A (Default is BCS spaces (0x20))	<R>
FSCLAS	File Security Classification. This field shall contain a valid value representing the classification level of the entire file. Valid values are T (=Top Secret), S (=Secret), C (=Confidential), R (=Restricted, U (=Unclassified).	1	T, S, C, R, or U	R
FSCODE	File Codewords. This field shall contain a valid indicator of the security compartments associated with the file. Typical values include one or more of the following separated by single BCS spaces (code 0x20): digraphs in accordance with Table C-1-4 and complete code words or project numbers. The selection of a relevant set of codewords and project numbers is application specific. If this field is all BCS spaces (code 0x20), it shall imply that no codewords apply to the file.	40	BCS-A (Default is BCS spaces (0x20))	<R>

Table C-1-1. NSIF file header (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
FSCTLH	File Control and Handling. This field shall contain valid security control and handling instructions associated with the file. Typical values include one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4 and complete codewords or project numbers. The selection of a relevant set of codewords and project numbers is application specific. If this field is all BCS spaces (code 0x20), it shall imply that no control and handling instructions apply to the file.	40	BCS-A (Default is BCS spaces (0x20))	<R>
FSREL	File Releasing Instructions. This field shall contain a valid list of countries and/or groups of countries to which the file is authorised for release. Valid items in the list are one or more or the following separated by single BCS spaces (code 0x20) within the field: country codes and groupings that are digraphs in accordance with STANAG 1059. If this field is all BCS spaces (code 0x20), it shall imply that no file release instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>
FSCAUT	File Classification Authority. This field shall contain a valid identity code of the classification authority for the file. The code shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no file classification authority applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
FSCTLN	File Security Control Number. This field shall contain a valid security control number associated with the file. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no file security control number applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
FSDWNG	File Security Downgrade. This field shall contain a valid indicator that designates the date on which a declassification or downgrading action is to take place. The valid values are (1) the calendar date in the format YYMMDD or (2) all BCS spaces (code 0x20), to imply that no file security downgrade condition applies.	6	BCS-A (Default is BCS spaces (0x20))	<R>
FSCOP	File Copy Number. This field shall contain the copy number of the file. If this field is all BCS zeroes (code 0x30), it shall imply that there is no tracking of numbered file copies.	5	BCS-N integer 00000-99999 (Default is 00000)	R
FSCPYS	File Number of Copies. This field shall contain the total number of copies of the file. If this field is all BCS zeroes (code 0x30), it shall imply that there is no tracking of numbered file copies.	5	BCS-N integer 00000-99999 (Default is 00000)	R
ENCRYP	Encryption. This field shall contain the value 0 until such time as this specification is updated to define the use of other values.	1	0 = Not Encrypted	R
ONAME	Originator's Name. This field shall contain a valid name for the operator who originated the file. If the field is all BCS spaces (code 0x20), it shall mean that no operator is assigned responsibility for origination.	27	BCS-A (Default is BCS spaces (0x20))	<R>

Table C-1-1. NSIF file header (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
OPHONE	Originator's Phone Number. This field shall contain a valid phone number for the operator who originated the file. If the field is all BCS spaces (code 0x20), it shall mean that no phone number is available for the operator assigned responsibility for origination.	18	BCS-A (Default is BCS spaces (0x20))	<R>
FL	File Length. This field shall contain the length in bytes of the entire file including all headers, subheaders, and data.	12	BCS-N integer 000000000388-999999999999	R
HL	NSIF File Header Length This field shall contain a valid length in bytes of the NSIF file header.	6	BCS-N integer 000388-999999	R
NUMI	Number of Images. This field shall contain the number of separate image items included in the file. This field shall be 0 if and only if no images are included in the file.	3	BCS-N integer 000-999	R
NOTE: LISHnnn and LInnn fields repeat in pairs as follows LISH001, LI001; LISH002, LI002; .....LISHnnn,LInnn.				
LISHnnn	Length of nth Image Subheader. This field shall contain a valid length in bytes for the nnnth image subheader, where nnn is the number of the image counting from the first image (nnn=001) in order of the images' appearance in the file. This field shall occur as many times as specified in the NUMI field. This field is conditional and shall be omitted if the NUMI field contains 0.	6	BCS-N integer 000439-999999	C
LInnn	Length of nth Image. This field shall contain a valid length in bytes of the nnnth image, where nnn is the image number of the image counting from the first image (nnn=001) in order of the images' appearance in the file. If the image is compressed, the length after compression shall be used. This field shall occur as many times as specified in the NUMI field. This field is conditional and shall be omitted if the NUMI field contains 0.	10	BCS-N integer 0000000001-9999999999	C
NUMS	Number of Graphics. This field shall contain the number of separate graphic items included in the file. This field shall be 0 if and only if no graphics are included in the file.	3	BCS-N integer 000-999	R
NOTE: LSSHnnn and LSnnn fields repeat in pairs as follows LSSH001, LS001; LSSH002, LS002; .....LSSHnnn,LSnnn.				
LSSHnnn	Length of nth Graphic Subheader. This field shall contain a valid length in bytes for the nnnth graphic subheader, where nnn is the number of the graphics counting from the first graphic (nnn=001) in the order of the graphics' appearance in the file. This field shall occur as many times as specified in the NUMS field. This field is conditional and shall be omitted if the NUMS contains 0.	4	BCS-N integer 0258-9999	C
LSnnn	Length of nth Graphic. This field shall contain a valid length in bytes of the nnnth graphic, where nnn is the number of the graphic, counting from the first graphic (nnn=001) in the order of the graphics' appearance in the file. This field shall occur as many times as specified in the NUMS field. This field is conditional and shall be omitted if NUMS field contains 0.	6	BCS-N integer 000001-999999	C

Table C-1-1. NSIF file header (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
NUMX	Reserved for Future Use. This field is reserved for future use and shall be filled with BCS zeroes (code 0x30).	3	000	R
NUMT	Number of Text Files. This field shall contain the number of separate text items included in the file. This field shall be 0 if and only if no text items are included in the file.	3	BCS-N integer 000-999	R
NOTE: LTSHnnn and LTnnn fields repeat in pairs as follows LTSH001, LT001; LTSH002, LT002; .....LTSHnnn,LTnnn.				
LTSHnnn	Length of n^{th} text subheader. This field shall contain a valid length in bytes for the nnn^{th} text item subheader, where nnn is the number of the text item, counting from the first text item (nnn=001) in the order of the text items' appearance in the file. This field shall occur as many times as specified in the NUMT field. This field is conditional and shall be omitted if the NUMT field contains 0.	4	BCS-N integer 0282-9999	C
LTnnn	Length of n^{th} Text File. This field shall contain a valid length in bytes of the nnn^{th} text item, where nnn is the number of the text item, counting from the first text item (nnn=001) in the order of the text items' appearance in the file. This field shall occur as many times as specified in the NUMT field. This field is conditional and shall be omitted if the NUMT field contains 0.	5	BCS-N integer 00001-99999	C
NUMDES	Number of Data Extension Segments. This field shall contain the number of separate data extension segments included in the file. This field shall be 0 if and only if no data extension segments are included in the file.	3	BCS-N integer 000-999	R
NOTE: LDSHnnn and LDnnn fields repeat in pairs as follows LDSH001, LD001; LDSH002, LD002; .....LDSHnnn,LDnnn.				
LDSHnnn	Length of n^{th} Data Extension Segment Subheader. This field shall contain a valid length in bytes for the nnn^{th} data extension segment subheader, where nnn is the number of the data extension segment counting from the first data extension segment (nnn=001) in order of the data extension segment's appearance in the file. This field shall occur as many times as are specified in the NUMDES field. This field is conditional and shall be omitted if the NUMDES field contains 0.	4	BCS-N integer 0201-9999	C
LDnnn	Length of n^{th} Data Extension Segment Data. This field shall contain a valid length in bytes of the data in the nnn^{th} data extension segment, where nnn is the number of the data extension segment counting from the first data extension segment (nnn=001) in order of the data extension segment's appearance in the file. This field shall occur as many times as are specified in the NUMDES field. This field is conditional and shall be omitted if the NUMDES fields contains 0.	9	BCS-N integer 000000001-999999999	C
NUMRES	Number of Reserved Extension Segments. This field shall contain the number of separate reserved extension segments included in the file. This field shall be 0 if and only if no reserved extension segments are included in the file.	3	BCS-N integer 000-999	R
NOTE: LRESHnnn and LREnnn fields repeat in pairs as follows LRESH001, LRE001; LRESH002, LRE002; .....LRESHnnn,LREnnn.				

Table C-1-1. NSIF file header (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
LRESHnnn	Length of nth Reserved Extension Segment Subheader. This field shall contain a valid length in bytes for the nnnth reserved extension segment subheader, where nnn is the number of the reserved extension segment counting from the first reserved extension segment (nnn=001) in order for the reserved extension segment's appearance in the file. This field shall occur as many times as are specified in the NUMRES field. This field is conditional and shall be omitted if the NUMRES field contains 0.	4	BCS-N integer 0001-9999	C
LREnnn	Length of nth Reserved Extension Segment Data Field. This field shall contain a valid length in bytes for the nnnth reserved extension segment subheader, where nnn is the number of the reserved extension segment counting from the first reserved extension segment (nnn=001) in order of the reserved extension segment's appearance in the file. This field shall occur as many times as are specified in the NUMRES field. This field is conditional and shall be omitted if the NUMRES field contains 0.	7	BCS-N integer 0000001-9999999	C
UDHDL	User Defined Header Data Length. A value of 0 shall mean that no registered tagged record extensions are included in the NSIF file header. If a registered tagged record extension exists, the field shall contain the sum of the length of all the registered tagged record extensions (see paragraph 26a) appearing in the UDHD field plus 3 bytes (length of UDHOFL field). If a registered tagged record extension is too long to fit in the UDHD field, it may be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-99999	R
UDHOFL	User Defined Header Overflow. This field shall contain BCS zeroes (code 0x30) if the tagged record extensions in UDHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field UDHDL contains 0.	3	BCS-N integer 000-999	C
UDHD	User Defined Header Data. If present, this field shall contain user defined registered tagged record extension data (see paragraph 26a). The length of this field shall be the length specified by the field UDHDL minus 3 bytes. Registered tagged record extensions shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first registered tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last registered tagged record extension to appear in the field. This field shall be omitted if the field UDHDL contains 0.	†[1]	User defined	C

Table C-1-1. NSIF file header (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
XHDL	Extended Header Data Length. A value of 0 shall mean that no controlled tagged record extensions are included in the NSIF file header. If a controlled tagged record extension exists, the field shall contain the sum of the length of all the controlled tagged record extensions (see paragraph 26a) appearing in the XHD field plus 3 bytes (length of XHDLOFL field). If a controlled tagged record extension is too long to fit in the XHD field, it may be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-99999	R
XHDLOFL	Extended Header Data Overflow. This field shall contain BCS zeroes (code 0x30) if the tagged record extensions in XHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field XHD contains 0.	3	BCS-N integer 000-999	C
XHD	Extended Header Data. If present, this field shall contain controlled tagged record extensions (see paragraph 26b) approved and under configuration management of the Custodian. The length of this field shall be the length specified by the field XHDL minus 3 bytes. Controlled tagged record extensions shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first controlled tagged record extension appearing in the field. The last byte of this field shall be the last controlled tagged record extension to appear in the field. This field shall be omitted if the field XHDL contains 0.	††[1]	Controlled Tagged Record Extensions	C

†[1] As specified in UDHDL value minus 3 bytes
††[1] As specified in XHDL value minus 3 bytes

Table C-1-2 NSIF image item category and representation

IMAGE CATEGORY (ICAT)	DEFINITION	IMAGE REPRESENTATION (IREP)	STANDARD EXTENSION
VIS SL TI FL RD EO OP HR HS CP BP SAR SARIQ IR MS FP MRI XRAY CAT	Visible Imagery Side-Looking Radar Thermal Infrared Forward Looking Infrared Radar Electro-optical Optical High Resolution Radar Hyperspectral Colour Frame Photography Black/White Frame Photography Synthetic Aperture Radar SAR Phase History Infrared Multispectral Fingerprints Magnetic Resonance Imagery X-rays CAT Scans	MONO, RGB, RGB/LUT, YCbCr, MULTI	If geo-referenced, presence of spatial location and positional accuracy is mandatory. Source description may be transmitted.
MAP	Raster Maps	MONO, RGB, RGB/LUT, YCbCr	If geo-referenced, presence of spatial location and positional accuracy is mandatory. Source description may be transmitted.
LEG	Legends	MONO, RGB, RGB/LUT, YCbCr	none
PAT	Colour Patch	RGB, YCbCr	none
DTEM	Matrix Data (elevations)	1D, ND	Presence of spatial location and positional accuracy is mandatory. Source description may be transmitted.
MATR	Matrix Data (other)	1D, ND	Presence of spatial location and positional accuracy is mandatory. Source description may be transmitted.
LOCG	Location Grid	2D	none

Table C-1-3 NSIF image subheader
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional
("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
IM	File Part Type. This field shall contain the characters "IM" to identify the subheader as an image subheader..	2	IM	R
IID	Image ID. This field shall contain a valid alphanumeric identification code associated with the image. The valid codes are determined by the application.	10	BCS non-blank User defined	R
IDATIM	Image Date & Time. This field shall contain the time (UTC) of the files origination in the format CCYYMMDDhhmmss, where CC is the first two digits of the year (00-99), YY is the last two digits of the year (00-99), MM is the month (01-12), DD is the day (0-31), hh is the hour (00-23), mm is the minute (00-59), ss is the second (00-59). UTC (Zulu) is assumed to be the time zone designator to express the time of day.	14	CCYYMMDDhhmmss	R
TGTID	Target ID. This field shall contain the identification of the primary target in the format, BBBBBBBBBBFFFFFCC, consisting of ten characters of BE (Basic Encyclopaedia) identifier, followed by five characters of functional category code, followed by the two character country code as specified in STANAG 1059.	17	BCS-A (Default is BCS spaces (0x20))	<R>
ITITLE	Image Title. This field shall contain the title of the image.	80	BCS-A (Default is BCS spaces (0x20))	<R>
ISCLAS	Image Security Classification. This field shall contain a valid value representing the classification level of the image. Valid values are: T (=Top Secret), S (=Secret), C (=Confidential), R (=Restricted), U (=Unclassified).	1	T, S, C, R, or U	R
ISCODE	Image Codewords. This field shall contain a valid indicator of the security compartments associated with the image. Valid values are one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4, and complete codewords or project numbers. The selection of a relevant set of codewords and project numbers is specific to the application. If this field is all BCS spaces (code 0x20), it shall imply that no codewords apply to the image.	40	BCS-A (Default is BCS spaces (0x20))	<R>
ISCTLH	Image Control and Handling. This field shall contain valid security handling instructions associated with the image. Valid values are one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4, complete codewords and abbreviations of more than two characters, and phrases only if the words within the phrase are separated by hyphens. The selection of a relevant set of security handling instructions is implementation specific. If this field is all BCS spaces (code 0x20), it shall imply that no image control and handling instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
ISREL	Image Releasing Instructions. This field shall contain a valid list of countries and/or groups of countries to which the image is authorised for release. Valid items in the list are one or more of the following separated by single BCS spaces (code 0x20) within the field: country codes and groupings that are digraphs in accordance with STANAG 1059. If this field is all BCS spaces (code 0x20), it shall imply that no image release instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>
ISCAUT	Image Classification Authority. This field shall contain a valid identity code of the classification authority for the image. The code shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no image classification authority applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
ISCTLN	Image Security Control Number. This field shall contain a valid security control number associated with the image. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no image security control number applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
ISDWNG	Image Security Downgrade. This field shall contain a valid indicator that designates the date at which a declassification or downgrading action is to take place. The valid values are (1) the calendar date in the format YYMMDD and (2) the code "999999" when the originating agency's determination is required (OADR). If this field is all BCS spaces (code 0x20), it shall imply that no image security downgrade condition applies.	6	BCS-A (Default is BCS spaces (0x20))	<R>
ENCRYP	Encryption. This field shall contain the value BCS zero (code 0x30) until such time as this specification is updated to define the use of other values.	1	0=Not Encrypted	R
ISORCE	Image Source. This field shall contain a description of the source of the image. If the source of the data is classified, then the description shall be preceded by the classification, including codeword(s) contained in Table C-1-4. If this field is all BCS spaces (code 0x20), it shall imply that no image source data applies.	42	BCS-A (Default is BCS spaces (0x20))	<R>
NROWS	Number of Significant Rows in Image. This field shall contain the total number of rows of significant pixels in the image. When NPPBV$*$ NBPC$>$ NROWS, the remaining last rows (NPPBV$*$ NBPC - NROWS) shall contain fill data (that is, only the rows indexed 0 through NROWS -1 of the image contain "significant" data). The pixel fill values are determined by the application.	8	BCS-N integer 00000001-99999999	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
NCOLS	Number of Significant Columns in Image. This field shall contain the total number of columns of significant pixels in the image. When NPPBH$*$ NBPR$>$ NCOLS, the remaining last pixels of each column (NPPBH$*$ NBPR - NCOLS) shall contain fill data (that is, only the columns indexed 0 through NCOLS -1 of the image contain “significant” data). The pixel fill values are determined by the application.	8	BCS-N integer 00000001-99999999	R
PVTYPE	Pixel Value Type. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image. Valid entries are INT for integer, B for bi-level, SI for 2’s complement signed integer, R for real, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts, each represented in IEEE 32-bit floating point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts, each represented in IEEE 32-bit floating point representation (IEEE 754) and appearing in adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.	3	INT, B, SI, R, C	R
IREP	Image Representation. This field shall contain a valid indicator for the general kind of image represented by the data. Valid representation indicators are MONO for monochrome; RGB for red, green, or blue true colour, RGB/LUT for mapped colour; 1D for monoband matrix/grid data; 2D for two dimensional data in support of location grids; ND for multiband matrix/grid data; and MULTI for multiband imagery. In addition, compressed imagery can have this field set to YCbCr when compressed in the ITU-R Recommendation BT.601-5 colour space using JPEG (field IC=C3). This field should be used in conjunction with the ICAT, ISUBCATnn, and IREPBANDnn fields to interpret the significance of each band in the image.	8	MONO, RGB, RGB/LUT, 1D, 2D, ND, MULTI, YCbCr	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
ICAT	Image Category. This field shall contain a valid indicator of the specific category of image, raster or grid data. Valid categories include VIS for visible imagery, SL for side-looking radar, TI for thermal infrared, FL for forward looking infrared, RD for radar, EO for electro-optical, OP for optical, HR for high resolution radar, HS for hyperspectral, CP for colour frame photography, BP for black/white frame photography, SAR for synthetic aperture radar, SARIQ for SAR radio hologram, IR for infrared, MS for multispectral, FP for fingerprints, MRI for magnetic resonance imagery, XRAY for x-rays, and CAT for CAT scans. Valid categories for geographic products or geo-reference support data are MAP for raster maps, PAT for colour patch, LEG for legends, DTEM for elevation models, MATR for other types of matrix data, and LOCG for location grids. This field should be used in conjunction with the IREP, ISUBCATnn, and IREPBANDnn fields to interpret the significance of each band in the image.	8	VIS, SL, TI, FL, RD, EO, OP, HR, HS,CP, BP, SAR, SARIQ, IR MS, FP, MRI, XRAY, CAT, MAP, PAT, LEG, DTEM, MATR, LOCG (Default is VIS)	R
ABPP	Actual Bits-Per-Pixel Per Band This field shall contain the number of “significant bits” for the value in each band of each pixel without compression. Even when the image is compressed, ABPP contains the number of significant bits per pixel that were present in the image before compression. This field shall be less than or equal to Number of Bits Per Pixel (field NBPP). The number of adjacent bits within each NBPP is used to represent the value. These “representation bits” shall be left justified or right justified within the NBPP bits, according to the value in the PJUST field. For example, if 11-bit pixels are stored in 16 bits, their field shall contain 11 and NBPP shall contain 16. The default number of “significant bits” to be used (if this field is all 0s) is the value contained in NBPP.	2	BCS-N integer 01-24	R
PJUST	Pixel Justification. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the value 0. Any value other than L or R in this field shall indicate right justified.	1	L or R (Default is R)	R
ICORDS	Image Coordinate System. This field shall contain a valid code indicating the type of coordinate system used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO). The valid values for this field are : U=UTM expressed in Military Grid Reference System (MGRS) form, N=UTM (Northern hemisphere), S=UTM (Southern hemisphere), and G=Geographic. (Choice between N and S is based on hemisphere of northernmost point.) The default Geodetic reference system is WGS84. If no coordinate system is identified, a BCS space (code 0x20) shall be used.	1	U, G, N, S or (Default is BCS spaces (0x20))	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
IGEOLO	Image Geographic Location. This field shall contain an approximate geographic location, in terms of corner locations, of the image in the coordinate system specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0, MaxCol), (MaxRow, MaxCol), (MaxRow, 0). MaxCol and MaxRow shall be determined from the values contained, respectively, in NCOLS and NROWS as MaxCol = NCOLS -1 and MaxRow = NROWS -1. Valid corner locations in geographic coordinates shall be expressed as latitude and longitude. The format ddmmssX represents degrees, minutes, and seconds of latitude with X = N or S for north or south, and dddmmssY represents degrees, minutes, and seconds of longitude with Y = E or W for east or west, respectively. For the UTM coordinate system, coordinates shall be expressed either in plain UTM coordinates or using MGRS. Plain UTM coordinates use the format zzeeeeeennnnnnn where “zz” represents the UTM zone number, and “eeeeee,” “nnnnnnn” represent Easting and Northing. UTM expressed in MGRS use format zzBJKeeeeennnnn where “zzBJK” represents the zone, band and 100 km square within the zone and “eeeee,” “nnnnn” represent residuals of Easting and Northing. With the exception of UTM, there is no implied accuracy associated with the data in this field. Specific accuracy for coordinate systems are provided in extensions to NSIF.	60	ddmmssXdddmmssY (four times) or zzBJKeeeeennnnn (four times) or zzeeeeeennnnnnn (four times)	C
NICOM	Number of Image Comments. This field shall contain the valid number of 80 character blocks (ICOMn) that follow to be used as free text image comments.	1	BCS-N integer 0-9	R
ICOMn	Image Comment n. The field (ICOM1 through ICOMn), when present, shall contain free-form BCS-A text. They are intended for use as a single comment block and should be used that way. This field shall contain the n^{th} free text image comment, where n is defined as follows: $1 \leq n \leq NICOM$. If the image comment is classified, it shall be preceded by the classification, including codeword(s). This field shall be omitted if the value in the NICOM field is 0.	80	BCS-A User defined	C

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
IC	Image Compression. This field shall contain a valid code indicating the form of compression used in representing the image data. Valid values for this field are, C1 to mean bi-level, C3 to mean JPEG, C4 to mean Vector Quantization, C5 to mean lossless JPEG, and NC to mean the image is not compressed. Also valid are M1, M3, M4, and M5 for compressed images, and NM for uncompressed images indicating an image that contains a block mask and/or a transparent pixel mask. The format of a mask image is identical to the format of its corresponding non-masked image except for the presence of an Image Data Mask at the beginning of the image data area. The format of the Image Data Mask is described in paragraph 18b and is shown in Table C-1-3(A). The definitions of the compression schemes associated with codes C1/M1, C3/M3, C4/M4, and C4/M5 are given, respectively, in ITU-T RECMN T.4 AMD2, ISO/IEC 10918-1, ISO/IEC DIS 10918-3, and MIL-STD-188-199.	2	NC, NM, C1, C3, C4, C5, M1, M3, M4, M5	R
COMRAT	Compression Rate Code. If the Image Compression (IC) field contains, C1, C3, C4, C5, M1, M3, M4, or M5 this field shall be present and contain a code indicating the compression rate for the image. If the value in IC is C1 or M1, the valid codes are 1D, 2DS, and 2DH, where: 1D means One-dimensional Coding 2DS means Two-dimensional Coding Standard Vertical Resolution (K=2) 2DH means Two-dimensional Coding High Vertical Resolution (K=4) Explanation of these codes can be found in ITU-T RECMN T.4 AMD2. If the value in IC is C3 or M3, this field is used to identify the embedded quantization table(s) used by the JPEG compression algorithm. The value of this field shall be 00.0. Explanation of embedded tables can be found in the NSIF JPEG profile defined in accordance with ISO/IEC 10918-1. If the value in IC is C4 or M4, this field shall contain a value given in the form nn.n representing the number of bits-per-pixel for the compressed image. Explanation of the compression rate for vector quantization can be found in MIL-STD-188-199. If the value in IC is C5 or M5, this field shall contain a value given by ISO/IEC DIS 10918-3. This field is omitted if the value in IC is NC or NM.	4	BCS-A See description for constraints	C

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
NBANDS	Number of Bands. This field shall contain the number of data bands within the specified image. This field and the IREP field are interrelated and independent of the IMODE field. The corresponding values for (IREP, NBANDS) are (MONO, 1); (RGB, 3); (RGB/LUT, 1); (YCbCr, 3); (MULTI, 2-9); and 0 for multispectral images with greater than 9 bands. If the value is T, there is additional information in the DES TFS.	1	BCS-A integer 0-9 and T See description for details	R
XBANDS	Number of Multispectral Bands. When NBANDS contains the value 0, this field shall contain the number of bands comprising the multispectral image.	5	BCS-N integer 00010-99999	C
. . . . .				
NOTE: The fields IREPBANDnn through LUTDnnm repeat the number of times indicated in the NBANDS field or the XBANDS field.				
IREPBANDnn	nnth Band Representation. When NBANDS contains the value 1, this field shall contain all BCS spaces (code 0x20). In all other cases, this field shall contain a valid indicator of the interpretation of the nnth band. The band number is a positive integer when IREP contains MULTI. In all other cases, the use of this field is user defined. If the IREP field contains the value “1D”, this field shall contain “MX” or “EL.” If the IREP field contains the value “2D,” this field shall contain “LX” or “LY.” See Appendix 1 to Annex D for details. However, its purpose is to provide the significance of the nnth band of the image with regard to the general image type as recorded in IREP. The significance of each band in the image can be derived form the combination of the IREP, IREPBANDnn, ICAT, and ISUBCATnn fields.	2	BCS-A, (Default is BCS spaces (0x20)), R, G, B, Y, Cb, Cr, 01-09, LX, LY, MX, EL	R
ISUBCATnn	nnth Band Subcategory. (This field is repeated for each band). The use of this field is user-defined except for the location grids and matrix data. Its purpose is to provide the significance of the nnth bands of the image with regard to the specific category (ICAT) of the overall image. An example would be the wave length of IR imagery. For location grids, the number of bands is strictly equal to 2, consequently, there are only 2 fields ISUBCAT01 and ISUBCAT02. Standard values of these fields for the Location grids are either ISUBCAT01=CGX and ISUBCAT02=CGY for the cartographic X (Easting) and Y (Northing) bands, or ISUBCAT01=GGX, and ISUBCAT02=GGY, for the geographic X(longitude), and Y(latitude) bands. Standard values for the matrix and elevation data should be taken from DIGEST Part 4 Annex B.	6	BCS-A User defined (Default is BCS spaces (0x20))	<R>
IFCnn	nnth Band Image Filter Condition. This field shall contain the value N (to mean none). Other values are reserved for future use.	1	N	R
IMFLTnn	nnth Band Standard Image Filter Code. This field is reserved for future use. It shall be filled with BCS spaces (code 0x20).	3	Fill with BCS spaces (0x20)	<R>

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
NLUTSnn	nnth Band Number of LUTS. This field shall contain the number of look-up tables associated with the nnth band of the image. If the image is a single band (NBANDS=1), pseudocolour (IREP=RGB/LUT) image, this field shall contain the value 3. The first, second, and third LUTS, in this case, shall map the image to the Red, Green, and Blue display bands respectively.	1	BCS-N integer 0-4	R
NELUTnn	nnth Band Number of LUT Entries. This field shall contain the number of entries in each of the look-up tables for the nnth band of data. This field shall be omitted if the value in NLUTSnn is 0.	5	BCS-N integer 1-65536	C
LUTDnnm	nnth Band Data of the mth LUT. This field shall be omitted if the mth LUT of the nnth Band Number of LUTs is 0. Otherwise, this field shall contain the data defining the mmth look-up table for the nnth image band. Each entry in the look-up table is composed of one byte, ordered from most significant bit to least significant bit, representing a value form 0 to 255. To use the look-up table, for each integer k, $0 \leq k \leq$ NELUTnn-1, the pixel value k in the nnth image band shall be mapped to the value of the kth byte of the look-up table. This field supports only integer band data (PVTYPE = INT). NOTE: This is a repeating field based on the value of NLUTSnn. When there are more than one table (NELUTnn>1, the net effect is to have the LUT ordered in band sequential fashion, e.g., all the red values followed by green values followed by blue values.	†[3]	LUT Values	C
ISYNC	Image Sync code. This field shall contain BCS 0 (code 0x30)	1	0 = no sync code	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
IMODE	Image Mode. This field shall contain an indicator of whether the image bands are stored in the file sequentially or band interleaved by block or band interleaved by pixel format. Valid values are B, P, and S. The significance of the IMODE value must be interpreted with the knowledge of whether the image is JPEG compressed (IC=C3, C5, M3, or M5), VQ compressed (IC=C4, or M4), or uncompressed (IC=NC or NM). When IC=C1 or M1, the use of IMODE defaults to B. For the uncompressed case: The value S means band sequential, where all blocks for the first band are followed by all blocks for the second band, and so on: [(block1, band1), (block2, band1), ... (blockM, band1)], [(block1, band2), (block2, band 2), ... (blockM, band2)] ... [(block1, bandN), (block2, bandN), ... (blockM, bandN)]. The values B and P indicate variations on block sequential where all data from all bands for the first block is followed by all data from all bands for the second block, and so on. The variations are based on the way the bands are organised within each block. B means band interleaved by block. This means that within each block, the bands follow one another: [(block1, band1), (block1, band2), ...(block1, bandN)], [(block2, band1), (block2, band2), ... (block2, bandN)], ... [(blockM, band1), (blockM, band2), ... (blockM, bandN)]. P means band interleaved by pixel within each block: such as, for each block, one after the other, the full pixel vector (all band values) appears for every pixel in the block, one pixel after another, the block column index varying faster than the block row index. If the NBANDS field is 1, the cases B and S coincide. In this case, this field shall contain B. If the Number of Blocks is 1(NBPR = NBPC = 1), this field shall contain B for non-interleaved by pixel, and P for interleaved by pixel. The value S is only valid for images with multiple blocks and multiple bands. For the JPEG-compressed case: The presence of B, P, or S implies specific ordering of data within the JPEG image data representation. The interpretation of the values of IMODE for this case is specified in NSIF JPEG profiles of ISO/IEC 10918-1 and ISO/IEC DIS 10918-3. For the Vector Quantization compressed case: VQ compressed images are normally either RGB with a colour look-up table or monochromatic. In either case, the image is single band, and the IMODE field defaults to B. However, it is possible to have a multiband VQ compressed image in band sequential, band interleaved by block, or band, interleaved by pixel format.	1	B=Block Interleaved P=Pixel Interleaved S=Band Sequential	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
NBPR	<u>Number of Blocks Per Row</u>. This field shall contain the number of image blocks in a row of blocks (see paragraph 17b) in the horizontal direction. If the image consists of only a single block, this field shall contain the value one.	4	BCS-N integer 0001-9999	R
NBPC	<u>Number of Blocks Per Column</u>. This field shall contain the number of image blocks in a column of blocks (see paragraph 17b) in the vertical direction. If the image consists of only a single block, this field shall contain the value one.	4	BCS-N integer 0001-9999	R
NPPBH	<u>Number of Pixels Per Block Horizontal</u>. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that NBPR* NPPBH$NCOLS.	4	BCS-N integer 0001-8192	R
NPPBV	<u>Number of Pixels Per Block Vertical</u>. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that NBPC* NPPBV≥NROWS.	4	BCS-N integer 0001-8192	R
NBPP	<u>Number of Bits Per Pixel Per Band</u>. If IC contains NC, NM, C4, or M4, this field shall contain the number of storage bits used for the value from each component of a pixel vector. The value in this field always shall be greater than or equal to Actual Bits Per Pixel (ABPP). For example, if 11-bit pixels are stored in 16 bits, this field shall contain 16 and Actual Bits Per Pixel shall contain 11. If IC = C3, M3, C5, or M5, this field shall contain the value 8 or the value 12. If IC = C1, this field shall contain the value 1.	2	BCS-N integer 01-24	R
IDLVL	<u>Display Level</u>. This field shall contain a valid value that indicates the graphic display level of the image relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable file component (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one item. The meaning of display level is fully discussed in paragraph 14. The image or graphic component in the file having the minimum display level shall have attachment level 0.	3	BCS-N integer 001-999	R
IALVL	<u>Attachment Level</u>. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are 0, and the display level value of any other image or graphic in the file. The meaning of attachment level is fully discussed in paragraph 15. The image, graphic, or text component in the file having the minimum display level shall have attachment level 0.	3	BCS-N integer 000-998 (Default is 000)	R

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
ILOC	Image Location. The image location is specified by specifying the location of the first pixel of the first line of the image. This field shall contain the image location represented as rrrrrccccc, where rrrrr and ccccc are the row and column offset from the ILOC or SLOC value of the item to which the image is attached. The value of the field corresponds with the SLOC field of Table C-1-5. A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right and range from 00001 to 99999, while negative row and column values indicate offsets up and to the left and must be within the range -0001 to -9999. The location relative to the attached object of all displayable components can be computed from the offsets given in the ILOC or SLOC field.	10	BCS-N integer -9999≤rrrrr≤99999 to -9999≤ccccc≤99999 (Default is 0000000000)	R
IMAG	Image Magnification. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. Decimal values are used to indicate magnification, and decimal fraction values indicate reduction. For example, “2.30” indicates the original image has been magnified by a factor of “2.30,” while “0.5” indicates the original image has been reduced by a factor of 2. The default value is 1.0, indicating no magnification or reduction. In addition, the following values shall be used for reductions that are reciprocals of non-negative powers of 2: /2 (for 1/2), /4 (for 1/4), /8 (for 1/8), /16 (for 1/16), /32 (for 1/32), /64 (for 1/64), /128 (for 1/128).	4	BCS-A /2, /4, /8, /16, /32, /64, /128 or decimal value (Default is 1.0 followed by a space)	R
UDIDL	User Defined Image Data Length A value of 0 shall mean that no registered tagged record extensions are included in the header. If a registered tagged record extension exists, the field shall contain the sum of the length of all the registered tagged record extensions (see paragraph 26a) appearing in the UDID field plus 3 bytes (length of UDOFL field). If a registered tagged record extension is too long to fit in the UDID field, it shall be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-99999	R
UDOFL	User Defined Overflow. If present, this field shall contain 000 if the tagged record extensions in UDID do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field UDIDL contains 0.	3	BCS-N integer 000-999	C

Table C-1-3 NSIF image subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
UDID	User Defined Image Data. If present, this field shall contain user defined registered tagged record extensions (see paragraph 26a). The length of this field shall be the length specified by the field UDIDL minus 3. Registered tagged record extensions in this field for an image shall contain information pertaining specifically to the image. Registered tagged record extensions shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first registered tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last registered tagged record extension to appear in the field. This field shall be omitted if the field UDIDL contains 0.	††[3]	Registered Tagged Record Extensions	C
IXSHDL	Extended Subheader Data Length. This field shall contain the length in bytes in IXSHD plus 3 (length of IXSOFL). The length is 3 plus sum of the lengths of all the controlled tagged record extensions (see paragraph 26b) appearing in the IXSHD field. A value of 0 shall mean that no controlled tagged record extensions are included in the image subheader. If a controlled tagged record extension exists, the field shall contain the sum of the length of all the controlled tagged record extensions (see paragraph 26a) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field). If a controlled tagged record extension is too long to fit in the IXSHD field, it shall be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-99999	R
IXSOFL	Extended Subheader Overflow. If present, this field shall contain “000” if the tagged record extensions in IXSHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field IXSHDL contains 0.	3	BCS-N integer 000-999	C
IXSHD	Extended Subheader Data. If present, this field shall contain controlled tagged record extensions (see paragraph 26b) approved and under configuration management by the Custodian. The length of this field shall be the length specified by the field IXSHDL minus 3. Controlled tagged record extensions in this field for an image shall contain information pertaining specifically to the image. Controlled tagged record extensions shall appear one after the other in this field with no intervening bytes. The first byte of this field shall be the first byte of the first controlled tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last controlled tagged record extension to appear in the field. This field shall be omitted if the field IXSHDL contains 0.	†††[3]	Controlled Tagged Record Extensions	C

†[3] One Byte for each entry
††[3] As specified in UDIDL minus 3 bytes
†††[3] As specified in IXSHDL minus 3 bytes

Table C-1-3(A) NSIF image data mask table
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional
("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
IMDATOFF	Blocked Image Data Offset. This field is included if the IC value equals NM, M1, M3, M4, or M5. It identifies the offset from the beginning of the Image Data Mask to the first byte of the blocked image data. This offset, when used in combination with the offsets provided in the BMR fields, can provide random access to any recorded image block in any image band.	4	Binary integer: 0 to 2^{32} -1	C
BMRLNTH	Block Mask Record Length. This field is included if the IC value equals NM, M1, M3, M4, or M5. It identifies the length of each Block Mask Record in bytes. When present, the length of each Block Mask Record is 4 bytes. The total length of all the block Mask Records is equal to BMRLNTH $*$ NBPR $*$ NBPC $*$ NBANDS (one 4 byte record for each block of each band in the image). If all of the image blocks are recorded, this value may be set to 0, and the conditional BMR fields are not recorded/transmitted. Otherwise, the value may be set to 4, and the conditional BMR fields are recorded/transmitted and can be used as an off-set index for each image block in each band of the image. If this field is present, but coded as 0, then only a pad pixel mask is included.	2	Unsigned integer; 0x00=No Block mask record; 0x04=Block mask records (4 bytes each) are present	C
TMRLNTH	Pad Pixel Mask Record Length. This field is included if the IC value equals NM, M1, M3, M4, or M5. It identifies the length of each Pad Pixel Mask Record in bytes. When present, the length of each Pad Pixel Mask Record is 4 bytes. The total length of the Pad Pixel Mask Records is equal to TMRLNTH $*$ NBPR $*$ NBPC $*$ NBANDS (one 4 byte record for each block for each band in the image). If none of the image blocks contain pad pixels, this value is set to 0, and the conditional TMR fields are not recorded/transmitted. For IC value of M3, the value shall be set to 0. If this field is present, but coded as 0, then a Block Mask is included.	2	Unsigned integer; 0x00=No pad pixel mask records; 0x04=pad pixel mask records (4 bytes each) are present	C
TPXCDLNTH	Transparent Output Pixel Code Length. This field is included if the IC value equals NM, M1, M3, M4, or M5. It identifies the length in bits of the Transparent Output Pixel Code. If coded as 0, then no transparent pixels are present, and the TPXCD field is not recorded. For IC value of M3, the value shall be set to 0.	2	Unsigned integer; 0x00=No pad pixels; or pad pixel code length in bits (01-16)	C

Table C-1-3(A) NSIF image data mask table (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
TPXCD	Pad Output Pixel Code. This field is included if the IC value equals NM, M1, M3, M4, or M5 and TPXCDLNTH is not 0. It contains the output pixel code that represents a pad pixel in the image. This value is unique within the image, and allows the user to identify pad pixels. The pad pixel output code length is determined by TPXCDLNTH, but the value is stored in a maximum of 2 bytes. If the number of bits used by TPXCD is less than the number of bits available for storage, the value shall be justified in accordance with the PJUST field in the image subheader.	†[3A]	Binary integer; 0 to 2^n -1 where n=TPXCDLNTH	C
NOTE: The BMRnBNDm record repeats; one 4 byte record for each block of each band in the image.				
BMRnBNDm	Block n, Band m Offset This field shall contain the n^{th} Block Mask Record of band m. It is recorded/transmitted only if the BMRLNTH field is not 0. The field shall contain an offset in bytes from the beginning of the Blocked Image Data to the first byte of block n of band m. If block n of band m is not recorded/transmitted in the image data, the offset value is defaulted to 0xFFFFFFFF. The offsets for all blocks in band 1 are recorded followed by block offsets for band 2, etc. (band sequential). The number of BMR records for each band is NBPR∗ NBPC.	4	Binary integer Increment n prior to m 0≤n≤NBPR∗ NBPC -1 0≤m≤ max(NBANDS,XBANDS) (Default is 0xFFFFFFFF if the block is not recorded)	C
. . . .				
TMRnBNDm	Pad Pixel n, Band m This field shall contain the n^{th} Pad Pixel for band m. It is recorded/transmitted only if the TMRLNTH field is not 0. The field shall contain an offset in bytes from the beginning of the Blocked Image Data to the first byte of block n of band m if block n contains pad pixels, or 0xFFFFFFFF to indicate that this block does not contain pad pixels. The offsets for all blocks in band 1 are recorded followed by block offsets for band 2, etc. (band sequential). The number of TMR records for each band is NBPR∗ NBPC.	4	Binary integer Increment n prior to m 0≤n≤NBPR∗ NBPC.-1 0≤m≤ max(NBANDS,XBANDS) (Default is 0xFFFFFFFF if the block is not recorded)	C

†[3A] The length of the TPXCD field is the next highest number of bytes that can contain the number of bits identified in the TPXCDLNTH field. For example, a TPXCDLNTH value of 12 would be stored in a TPXCD field of two bytes.

Table C-1-4. Security control markings

CODEWORD	DIGRAPH
NOCONTRACT	NC
ORCON	OC
PROPIN	PI
WNINTEL	WI
LIMDIS	DS
ATOMAL	AL
COSMIC	CS
CNWDI	CN
CRYPTO	CR
FOUO	FO
FORMREST DATA	RD
SIOP	SH
SIOP/ESI	SE
COPYRIGHT	PX
EFTO	TX
LIM OFF USE (UNCLAS)	LU
NONCOMPARTMENT	NT
PERSONAL DATA	IN
SAO	SA
SAO-1	SL
SAO-2	HA
SAO-3	HB
SAO-SI-2	SK
SAO-SI-3	HC
SAO-SI-4	HD
SPECIAL CONTROL	SC
SPECIAL INTEL	SI
WARNING NOTICE - SEC CLAS IS BASED ON THE FACT OF EXISTENCE AND AVAIL OF THIS GRAPHIC	WN

Table C-1-5 NSIF graphic subheader
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional
(“†” annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
SY	File Part Type. This field shall contain the characters SY to identify the subheader as a graphic subheader.	2	SY	R
SID	Graphic ID. This field shall contain a valid alphanumeric identification code associated with the graphic. The valid codes are determined by the application.	10	BCS-A User defined, non-blank	R
SNAME	Graphic name. This field shall contain an alphanumeric for the graphic.	20	BCS-A (Default is BCS spaces (0x20))	<R>
SSCLAS	Graphic Security Classification. This field shall contain a valid value representing the classification level of the graphic. Valid values are: T (=Top Secret), S (=Secret), C (=Confidential), R (=Restricted), U (=Unclassified).	1	T, S, C, R, or U	R
SSCODE	Graphic Codewords. This field shall contain a valid indicator of the security compartments associated with the graphic. Valid values are one or more of the following separated by single BCS spaces within the file: digraphs in accordance with Table C-1-4, trigraphs not contained in Table C-1-4, and complete codewords or project numbers. The selection of a relevant set of codewords and project numbers is application specific. If this field is all BCS spaces (code 0x20), it shall imply that no codewords apply to the graphic.	40	BCS-A (Default is BCS spaces (0x20))	<R>
SSCTLH	Graphic Control and Handling. This field shall contain valid security handling instructions associated with the graphic. Valid values are one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4, trigraphs not contained in Table C-1-4, complete words and abbreviations of more than two characters, and phrases only if the words within the phrase are separated by hyphens. The selection of a relevant set of security handling instructions is implementation specific. If this field is all BCS spaces (code 0x20), it shall imply that no graphic control and handling instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>
SSREL	Graphic Releasing Instructions. This field shall contain a valid list of countries and/or groups of countries to which the graphic is authorised for release. Valid items in the list are one or more of the following separated by single BCS spaces (code 0x20) within the field: country codes and groupings that are digraphs in accordance with STANAG 1059. If this field is all BCS spaces (code 0x20), it shall imply that no graphic release instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>
SSCAUT	Graphic Classification Authority. This field shall contain a valid identity code of the classification authority for the graphic. The code shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no graphic classification authority applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>

Table C-1-5 NSIF graphic subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
SSCTLN	Graphic Security Control Number. This field shall contain a valid security control number associated with the graphic. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no graphic security control number applies.	20	BCS-A (Default is spaces)	<R>
SSDWNG	Graphic Security Downgrade. This field shall contain a valid indicator that designates the date at which a declassification or downgrading action is to take place. The valid values are (1) the calendar date in the format YYMMDD, or (2) the code "999999" when the originating agency's determination is required (OADR). If this field is all BCS spaces (code 0x20), it shall imply that no graphic security downgrade condition applies.	6	BCS-A (Default is spaces)	<R>
SENCRYP	Encryption. This field shall contain the value 0 until such time as this specification is updated to define the use of other values.	1	0=Not Encrypted	R
STYPE	Graphic Type. This field shall contain a valid indicator of the representation type of the graphic. The valid value is C, which means Computer Graphics Metafile. The graphic data contain a Computer Graphics Metafile in binary format that defines the graphic according to the specification of the profile of CGM for NSIF in ISO/IEC 8632-1. Future versions of the NSIF may include various pre-defined objects such as graphics for military units, vehicles, weapons, or aircraft.	1	C for CGM	R
SRES1	Reserved for Future Use. Reserved.	13	BCS-N integer 0000000000000- 9999999999999 (Default is 0000000000000)	R
SDLVL	Display Level. This field shall contain a valid value that indicates the graphic display level of the graphic relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable file component (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one item. The meaning of display level is discussed fully in paragraph 14. The graphic or image component in the file having the minimum display level shall have attachment level 0.	3	BCS-N integer 001-999	R
SALVL	Attachment Level. This field shall contain a valid value that indicates the attachment level of the graphic. Valid values for this field are 0 and the display level value of any other image or graphic in the file. The meaning of attachment level is discussed fully in paragraph 15. The graphic or image component in the file having the minimum display level shall have attachment level 0.	3	BCS-N integer 000-998 (Default is 000)	R

Table C-1-5 NSIF graphic subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
SLOC	Graphic Location. The graphics location is specified by providing the location of a point bearing a particular relationship to the graphic. For a CGM graphic, the point is the Virtual Device Coordinate (VDC) origin as defined in ISO/IEC 8632-1. This field shall contain the graphic location represented as rrrrrccccc, where rrrrr and ccccc are the row and column offset from the ILOC or SLOC value of the item to which the graphic is attached. The value of the field corresponds with the ILOC field of Table C-1-3. A row and column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right and range from 00001 to 99999, while negative row and column values indicate offsets up and to the left and must be within the range -0001 to -9999. The location relative to the attached object of all displayable components can be computed from the offsets given in the ILOC or SLOC field.	10	BCS-N -9999≤rrrrr≤99999 -9999≤ccccc≤99999 (Default is 0000000000)	R
SBND1	First Graphic Bound Location. This field shall contain an ordered pair of integers defining a location in Cartesian coordinates for use with CGM graphics. It is the upper left corner of the bounding box for the CGM graphic. See paragraph 21a for a complete description. The format is rrrrrccccc, where rrrrr is the row and ccccc is the column offset from ILOC or SLOC value of the item to which the graphic is attached. If the graphic is unattached (SALVL-0), rrrrr and ccccc represent offsets from the origin of the coordinate system that is common to all images and graphics in the file having attachment level 0. The range for rrrrr and ccccc shall be -9999 to 99999.	10	rrrrrccccc	R
SCOLOR	Graphic Colour. If STYPE = C, this field shall contain a C if the CGM contains any colour pieces or an M if it is monochrome (i.e., black, white, or levels of grey).	1	C, M	R
SBND2	Second Graphic Bound Location. This field shall contain an ordered pair of integers defining a location in Cartesian coordinates for use with CGM graphics. It is the lower right corner of the bounding box for the CGM graphic. See paragraph 21a for a complete description. The format is rrrrrccccc, where rrrrr is the row and ccccc is the column offset from ILOC or SLOC value of the item to which the graphic is attached. If the graphic is unattached (SALVL=0), rrrrr and ccccc represent offsets from the origin of the coordinate system that is common to all images and graphics in the file having attachment level 0. The range for rrrrr and ccccc shall be -9999 to 99999.	10	rrrrrccccc	R
SRES2	Reserved for Future Use. This field is reserved for future use. The default value shall be BCS spaces (code 0x20).	2	BCS-N integer 00-99 (Default is 00)	R

Table C-1-5 NSIF graphic subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
SXSHDL	Extended Subheader Data Length. A value of 0 shall mean that no controlled tagged record extensions are included in the graphic subheader. If a controlled tagged record extension exists, the field shall contain the sum of the length of all the controlled tagged record extensions (see paragraph 26a) appearing in the SXSHD field plus 3 bytes (length of SXSOFL field). If a controlled tagged record extension is too long to fit in the SXSHD field, it shall be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-09741	R
SXSOFL	Extended Subheader Overflow. If present, this field shall contain "000" if the tagged record extensions in SXSHD do not overflow into a DES or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field SXSHDL contains 0.	3	BCS-N 000-999	C
SXSHD	Extended Subheader Data. If present, this field shall contain controlled tagged record extensions (see paragraph 26b) approved and under configuration management by the Custodian. The length of this field shall be the length specified by the field SXSHDL minus 3. Controlled tagged record extensions in this field for a graphic shall contain information pertaining specifically to the graphic. Controlled tagged record extensions shall appear one after the other in this field with no intervening bytes. The first byte of this field shall be the first byte of the first controlled tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last controlled tagged record extension to appear in the field. This field shall be omitted if the field SXSHDL contains 0.	†[5]	Controlled Tagged Record Extensions	C

†[5] As specified by the SXSHDL field minus 3 bytes

Table C-1-6. NSIF text subheader
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional
(“†” annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
TE	File Part Type. This field shall contain the characters “TE” to identify the subheader as a text subheader.	2	TE	R
TEXTID	Text ID. This field shall contain a valid alphanumeric identification code associated with the text item. The valid codes are determined by the application.	7	BCS-A (User defined, non-blank)	R
TXTALVL	Text Attachment Level. This field shall contain a valid value that indicates the attachment level of the text. Valid values for this field are 000 and the display level value of any image or graphic in the file.	3	BCS-N integer 000-998 (Default is 000)	R
TXTDT	Text Date & Time. This field shall contain the time (UTC) of origination of the text in the format CCYYMMDDhhmmss, where CC is the first two digits of the year (00-99), YY is the last two digits of the year (00-99), MM is the month (01-12), DD is the day (01-31), hh is the hour (00-23), mm is the minute (00-59), and ss is the second (00-59). UTC (Zulu) is assumed to be the time zone designator to express the time of day.	14	CCYYMMDDhhmmss	R
TXTITL	Text Title. This field shall contain the title of the text item.	80	BCS-A (Default is BCS spaces (0x20))	<R>
TSCLAS	Text Security Classification. This field shall contain a valid value representing the classification level of the text item. Valid values are: T (=Top Secret), S (= Secret), C (=Confidential), R (=Restricted), U (=Unclassified).	1	T, S, C, R, or U	R
TSCODE	Text Codewords. This field shall contain a valid indicator of the security compartments associated with the text item. Valid values are one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4, trigraphs not contained in Table C-1-4, and complete codewords or project numbers. The selection of a relevant set of codewords and project numbers is application specific. If this field is all BCS spaces (code 0x20), it shall imply that no codewords apply to the text item.	40	BCS-A (Default is BCS spaces (0x20))	<R>
TSCTLH	Text Control and Handling. This field shall contain valid security handling instructions associated with the text item. Valid values are one or more of the following separated by single BCS spaces (code 0x20) within the field: digraphs in accordance with Table C-1-4, trigraphs not contained in Table C-1-4, complete words and abbreviations of more than two characters, and phrases only if the words within the phrase are separated by hyphens. The selection of a relevant set of security handling instructions is implementation specific. If this field is all BCS spaces (code 0x20), it shall imply that no text control and handling instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>

Table C-1-6. NSIF text subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
TSREL	Text Releasing Instruction. This field shall contain a valid list of countries and/or groups of countries to which the text item is authorised for release. Valid items in the list are one or more of the following separated by single BCS spaces (code 0x20) within the field: country codes and groupings that are digraphs in accordance with STANAG 1059. If this field is all BCS spaces (code 0x20), it shall imply that no text release instructions apply.	40	BCS-A (Default is BCS spaces (0x20))	<R>
TSCAUT	Text Classification Authority. This field shall contain a valid identity code of the classification authority for the text item. The code shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no text classification authority applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
TSCTLN	Text Security Control Number. This field shall contain a valid security control number associated with the text item. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s). If this field is all BCS spaces (code 0x20), it shall imply that no text security control number applies.	20	BCS-A (Default is BCS spaces (0x20))	<R>
TSDWNG	Text Security Downgrade. This field shall contain a valid indicator that designates the time at which a declassification or downgrading action is to take place. Valid values are (1) the calendar date in the format YYMMDD, (2) the code “999999” when the originating agency’s determination is required (OADR). If this field is all BCS spaces (code 0x20), it shall imply that no text security downgrade condition applies.	6	BCS-A (Default is BCS spaces (0x20))	<R>
ENCRYP	Encryption. This field shall contain the value 0 until such time as this specification is updated to define the use of other values.	1	0=Not Encrypted	R
TXTFMT	Text Format. This field shall contain a valid three-character code indicating the format or template to be used to display the text. Valid codes are MTF to indicate USMTF (Refer to ADatP-3), STA to indicate BCS-A, and OTH to indicate other, such as user defined. Refer to section 3 for additional discussion of standards and the BCS.	3	MTF, STA, OTH	R
TXSHDL	Extended Subheader Data Length. A value of 0 shall mean that no controlled tagged record extensions are included in the text subheader. If a controlled tagged record extension exists, the field shall contain the sum of the length of all the controlled tagged record extensions (see paragraph 26a) appearing in the TSXHD field plus 3 bytes (length of TSXOFL field). If a controlled tagged record extension is too long to fit in the TXSHD field, it shall be put in a data extension segment (see paragraph 26c(1)).	5	BCS-N integer 00000 or 00003-09717	R

Table C-1-6. NSIF text subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
TXSOFL	Extended Subheader Overflow. If present, this field shall contain “000” if the tagged record extensions in TXSHD do not overflow into a DES, or shall contain the sequence number in the file of the DES into which they do overflow. This field shall be omitted if the field TXSHDL contains 0.	3	BCS-N (000-999)	C
TXSHD	Extended Subheader Data. If present, this field shall contain controlled tagged record extensions (see paragraph 26b) approved and under configuration management by the Custodian. The length of this field shall be the length specified by the field TXSHDL minus 3 bytes. Controlled tagged record extensions in this field shall contain information pertaining specifically to the text. Controlled tagged record extensions shall appear one after the other in this field with no intervening bytes. The first byte of this field shall be the first byte of the first controlled tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last controlled tagged record extension to appear in the field. This field shall be omitted if the field TXSHDL contains 0.	†[6]	BCS-A	C

†[6] As specified by the value in the TXSHDL field minus 3 bytes

Table C-1-7. Registered and controlled tagged record extension format
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional
(“†” annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
RETAG or CETAG	Unique Extension Type Identifier. This field shall contain a valid alphanumeric identifier properly registered with the Custodian.	6	BCS-A	R
REL or CEL	Length of REDATA Field This field shall contain the length in bytes of the data contained in REDATA or CETAG. The tagged record’s length is 11 + REL or CEL.	5	BCS-N (00001 to 99985)	R
REDATA or CEDATA where appropriate	User-defined Data. This field shall contain data of either binary or character data types defined by and formatted according to user specification. The length of this field shall not cause any other NSIF field length limits to be exceeded, but is otherwise fully user defined.	℘[7]	User-defined	R

†[7] As indicated in REL or CEL field

Table C-1-8. NSIF data extension segment subheader
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional
("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
DE	File Part Type. This field shall contain the characters "DE" to identify the subheader as a data extension.	2	DE	R
DESTAG	Unique DES Type Identifier. This field shall contain a valid alphanumeric identifier properly registered with the Custodian.	25	BCS-A (Registered value only)	R
DESVER	Version of the Data Field Definition. This field shall contain the alphanumeric version number of the use of the tag. The version number is assigned as part of the registration process.	2	BCS-N (01 to 99)	R
DESSG	Security Group. This field shall contain a series of fields containing security classification information for the DES as a whole. The fields included shall mirror those of the NSIF file header from FSCLAS through FSDWNG, including field length and content, but be applicable to the DES only. The field names shall be DESCLAS through DESDEVT respectively, simply substituting "DE" for "F."	167	(See Table C-1-1, FSCLAS through FSDWNG)	R
DESOFLW	Overflowed Header Type. This field shall be present if DESTAG = "Registered Extensions" or "Controlled Extensions." Its presence indicates that the DES contains a tagged record extension that would not fit in the file header or component header where it would ordinarily be located. Its value indicates the data type to which the enclosed tagged record is relevant. If the value of DESTAG is "Controlled Extensions," the valid values for DESOFLOW are XHD, IXSHD, SXSHD, or TXSHD. If the value of DESTAG is "Registered Extensions," the valid values for DESOFLW are UDHD and UDID.	6	BCS-A (XHD, IXSHD, SXSHD, TXSHD, UDHD, UDID)	C
DESITEM	Data Item Overflowed. This field shall be present if DESOFLW is present. It shall contain the number of the data item in the file, of the type indicated in DESOFLW to which the tagged record extensions in the segment apply. For example, if DESOFLW = UDID and DESITEM = 3, then the tagged record extensions in the segment apply to the third image in the file. If the value of DESOFLW = UDHD, the value of DESITEM shall be 0.	3	BCS-N (000 to 999)	C
DESSHL	Length of User-defined Subheader Fields. This field shall contain the number of bytes in the field DESSHF. If this field contains 0, DESSHF shall not appear in the DES subheader. This field shall contain 0 if DESTAG = "Registered Extensions" or "Controlled Extensions."	4	BCS-N (0000-9999)	R
DESSHF	User-defined Subheader Fields. This field shall contain user-defined fields. Data in this field shall be alphanumeric, formatted according to user specification.	†[8]	BCS-A (User defined)	C

Table C-1-8. NSIF data extension segment subheader (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
DESDATA	User-defined Data Field. This field shall contain data of either binary or character types defined by and formatted according to the user's specification. However, if the DESTAG is "Registered Extensions" or "Controlled Extensions," the tagged records shall appear according to their definition with no intervening bytes. The length of this field shall not cause any other NSIF field length limits to be exceeded, but is otherwise fully user defined.	††8	User defined.	R

†8 Value specified in DESSHL

††8 Determined by user. If DESTAG = "Registered Extensions" or "Controlled Extensions," this signifies the sum of the lengths of the included tagged records.

Table C-1-9. NSIF reserved extension segment subheader

TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
RE	File Part Type. This field shall contain the characters "RE" to identify the subheader as a reserved extension.	2	RE	R
RESTAG	Unique RES Type Identifier. This field shall contain a valid alphanumeric identifier properly registered with the Custodian.	25	BCS-A (Registered value only, non-blank)	R
RESVER	Version of the Data Field Definition. This field shall contain the alphanumeric version number of the use of the tag. The version number is assigned as part of the registration process.	2	BCS-N (01 to 99)	R
RESSG	Security Group. This field shall contain a series of fields containing security classification information for the DES as a whole. The fields included shall mirror those of the NSIF file header from FSCLAS through FSDWNG, including the field length and content, but be applicable to the DES only. The field names shall be RESCLAS through RESDEVT respectively, simply substituting "RE" for "F."	167	(See Table C-1-1, FSCLAS through FSDWNG)	R
RESSHL	Length of User-defined Subheader Fields. This field shall contain the number of bytes in the field RESSHF. If this field contains 0, RESSHF shall not appear in the RES subheader.	4	BCS-N (0000-9999)	R
RESSHF	User-defined Subheader Fields. This field shall contain user-defined fields. Data in this field shall be alphanumeric, formatted according to user specification.	†9	BCS-A (User defined)	C
RESDATA	User-defined Data Field. This field shall contain data of either binary or character types defined by and formatted according to the user's specification. The length of this field shall not cause any other NSIF field length limits to be exceeded, but is otherwise fully user defined.	††9	User defined	R

†9 Value specified in RESSHL

††9 Determined by the definition of the specific reserved extension segment as registered and controlled with the Custodian.

APPENDIX 2 TO ANNEX C. EXAMPLE NSIF FILE

This appendix contains general or explanatory information that may be helpful but is not mandatory.

1. Use of NSIF. Though the NSIF was conceived initially to support the transmission of a file composed of a single base image, image insets (subimage overlays), graphic overlays, and text, its current form makes it suitable for a wide variety of file exchange needs. One of the flexible features of the NSIF is that it allows several items of each data type to be included in one file, yet any of the data types may be omitted. Thus, for example, the NSIF may equally well be used for the storage of a single portion of text, a single image or a complex composition of several images, graphics, and text. The following section discusses an example NSIF file of moderate complexity.

2. Example file. Table C-2-1 shows the contents of the fields in the header of a sample NSIF file composed of two image segments, (one base image, one inset image), five graphic overlays, and five text selections. Figure C-2-1 shows a part of the sample file as a composite image with its overlay graphics. In a NSIF file, the data for each data item is preceded by the item's subheader. The subheader for a data type is omitted if no items of that type are included in the file. Subheader field contents for items in the sample file are shown in Table C-2-2 through Table C-2-9.

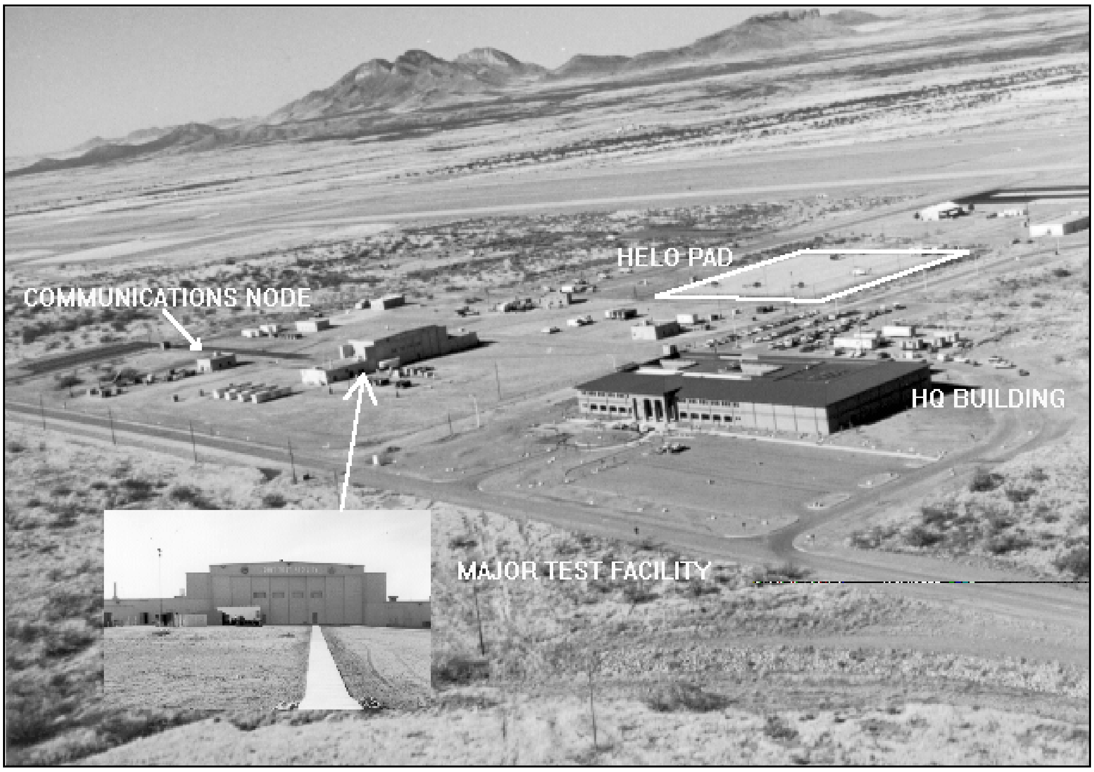


Figure C-2-1. Sample file composite image

Table C-2-1. Example NSIF file header

NSIF HEADER FIELD	FORMAT	COMMENT
File Type & Version (FHDR)	NSIF01.00	9 characters
Complexity Level (CLEVEL)	05	2 characters - images less than or equal to 8k x 8k
System Type (STYPE)		4 blank characters
Originating Station ID (OSTAID)	U21SOO90	8 characters followed by 2 BCS spaces (code 0x20) - 10 characters

Table C-2-1. Example NSIF file header (continued)

NSIF HEADER FIELD	FORMAT	COMMENT
File Date & Time (FDT)	19960930224632	14 characters
File Title (FTITLE)	MAJOR TEST FACILITY	19 characters followed by 61 BCS spaces (code 0x20) - 80 characters
File Security Classification (FSCLAS)	U	1 character
File Codewords (FSCODE)		40 BCS spaces (code 0x20)
File Control & Handling (FSCTLH)		40 BCS spaces (code 0x20)
File Releasing Instructions (FSREL)		40 BCS spaces (code 0x20)
File Classification Authority (FSCAUT)		20 BCS spaces (code 0x20)
File Security Control Number (FSCTLN)		20 BCS spaces (code 0x20)
File Security Downgrade (FSDWNG)		6 BCS spaces (code 0x20)
File Copy Number (FSCOP)	00000	5 digits - all zeros indicate there is no tracking of file copies
File Number of Copies (FSCPYS)	00000	5 digits - all zeros indicate there is no tracking of file copies
Encryption (ENCRYP)	0	Required default no encryption
Originator's Name (ONAME)	W. Tempel	9 characters followed by 18 BCS spaces (code 0x20) - 27 characters
Originator's Phone Number (OPHONE)	44 1480 84 5611	15 characters followed by 3 BCS spaces (code 0x20) - 18 characters
File Length (FL)	000002925155	12 digits
NSIF File Header Length (HL)	000515	6 digits
Number of Images (NUMI)	002	3 digits
Length of 1st Image Subheader (LISH001)	000679	6 digits
Length of 1st Image (LI001)	0002730600	10 digits
Length of 2nd Image Subheader (LISH002)	000439	6 digits
Length of 2nd Image (LI002)	0000089600	10 digits
Number of Graphics (NUMS)	005	3 digits
Length of 1st Graphic Subheader (LSSH001)	0258	4 digits
Length of 1st Graphic (LS001)	000122	6 digits
Length of 2nd Graphic Subheader (LSSH002)	0258	4 digits
Length of 2nd Graphic (LS002)	000122	6 digits
Length of 3rd Graphic Subheader (LSSH003)	0258	4 digits

Table C-2-1. Example NSIF file header (continued)

NSIF HEADER FIELD	FORMAT	COMMENT
Length of 3rd Graphic (LS003)	000150	6 digits
Length of 4th Graphic Subheader (LSSH004)	0258	4 digits
Length of 4th Graphic (LS004)	000112	6 digits
Length of 5th Graphic Subheader (LSSH005)	0258	4 digits
Length of 5th Graphic (LS005)	000116	6 digits
Reserved for future use (NUMX)	000	3 digits
Number of Text Files (NUMT)	005	3 digits
Length of 1st Text Subheader (LTSH001)	0282	4 digits
Length of 1st Text File (LT001)	20000	5 digits
Length of 2nd Text Subheader (LTSH002)	0282	4 digits
Length of 2nd Text File (LT002)	20000	5 digits
Length of 3rd Text Subheader (LTSH003)	0282	4 digits
Length of 3rd Text File (LT003)	20000	5 digits
Length of 4th Text Subheader (LTSH004)	0282	4 digits
Length of 4th Text File (LT004)	20000	5 digits
Length of 5th Text Subheader (LTSH005)	0282	4 digits
Length of 5th Text File (LT005)	20000	5 digits
Number of Data Extension Segments (NUMDES)	000	3 digits
Number of Reserved Data Extension Segments (NUMRES)	000	3 digits
User Defined Header Data Length (UDHDL)	00000	5 digits
Extended Header Data Header Length (XHDL)	00000	5 digits

a. Explanation of the file header. The File Type and Version,NSIF 01.00, is listed first. The next field contains the file's Complexity Level, in this case 05. A four character reserved field for the System Type, defaulted to blanks, appears next. An identification code containing ten characters for the station originating the primary information in the file is given next. The file origination date and time follow this and are given in UTC (Zulu) time format. This is followed by the File Title field containing up to 80 characters of free form text. The title of the sample file contains less than 80 characters, and therefore, the remainder of the field is padded with blanks. The File Security Classification follows and contains one character. Several security-related optional fields and a conditional field follow. They are File Codewords, File Control Handling, File Releasing Instructions, File Classification Authority, File Security Control Number, File Security Downgrade, File Copy Number, and File Number of Copies. File Encryption is given a "0" indicating that the file is not encrypted. The originator's name and phone number are given next. These fields may be left blank. Then the length in bytes of the entire file is given, including all headers, subheaders, and data. This is followed by the length in bytes of the NSIF file header. The Number of Images field contains the characters 002 to indicate two images are included in the file. This is followed by six characters to specify the length of the first image subheader, then ten characters for the length of the first image. The length of the second image subheader and the length of the second image follow. The next item in the file header is the Number of Graphics, which contains 005 to indicate that five graphics are present in the file. The next ten characters contain the Length of Graphic Subheader and Length of Graphic (four and six characters respectively) for the first through fifth graphic, one after the other. The field, Number of Text Files, is given as 005 and is followed by four characters specifying the length of the text subheader and five characters specifying the number of characters in the text segment for each of the five text segments. The Number of Data Extension Segments and Number of Reserved Extension Segments fields are given as "000." This completes the "roadmap" for separating the data subheaders from the actual data to follow. The next two fields in the header are the User Defined Header Data Length and the User Defined Header Data. User defined data could be used to include registered tagged record extensions that provide additional information about the file. In this example, however, the length of the user defined header data is given as zero; therefore, the User Defined Header Data Field is omitted. The last field in the header are the Extended Header Data Length. The length of the extended header is given as zero; therefore, the Extended Header Data field is omitted, indicating that no controlled tagged record extensions are included in the file header.

b. Explanation of the image subheaders.

Table C-2-2. Example of the first image subheader
("†" annotations are explained at the end of the table)

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (IM)	IM	2 characters
Image ID (IID)	0000000001	10 characters
Image Date & Time (IDATIM)	19960825203147	14 characters
Target ID (TGTID)		17 BCS spaces (code 0x20)
Image Title (ITITLE)	MAJOR TEST FACILITY AND HQ	26 characters followed by 54 BCS spaces (code 0x20) - 80 characters
Image Security Classification (ISCLAS)	U	1 character
Image Codewords (ISCODE)		40 BCS spaces (code 0x20)
Image Control and Handling (ISCTLH)		40 BCS spaces (code 0x20)
Image Releasing Instructions (ISREL)		40 BCS spaces (code 0x20)
Image Classification Authority (ISCAUT)		20 BCS spaces (code 0x20)
Image Security Control Number (ISCTLN)		20 BCS spaces (code 0x20)
Image Security Downgrade (ISDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	Required default
Image Source (ISORCE)	Hand-held digital camera model XYZ.	35 characters followed by 7 BCS spaces (code 0x20) - 42 characters
Number of Significant Rows in image (NROWS)	00001332	8 characters
Number of Significant Columns in image (NCOLS)	00002050	8 characters

Table C-2-2. Example of the first image subheader (continued)

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
Pixel Value Type (PVTYPE)	INT	3 characters - interpret pixel values as integers
Image Representation (IREP)	MONO	4 characters followed by 4 BCS spaces (code 0x20) - grey scale imagery
Image Class (ICAT)	VIS	3 characters followed by 5 BCS spaces (code 0x20) - visible imagery
Actual Bits-Per-Pixel Per Band (ABPP)	08	2 digits
Pixel Justification (PJUST)	R	1 character
Image Coordinate System (ICORDS)		BCS spaces (code 0x20) - indicates no geo location coordinates
Number of Image Comments (NICOM)	3	1 digit
†[2] Image Comment 1 (ICOM1)	This is a comment on Major Test Facility base and associated inset. This file w	80 characters
†[2] Image Comment 2 (ICOM2)	as developed at Fort Huachuca, Arizona. It shows the Joint Interoperability Tes	80 characters
†[2] Image Comment 3 (ICOM3)	t Command Building and associated range areas.	44 characters followed by 36 BCS spaces (code 0x20) - 80 characters
Image Compression (IC)	NC	2 characters - indicates no compression
Number of Bands (NBANDS)	1	1 digit
1st Band Representation (IREPBAND1)		2 BCS spaces (code 0x20)
1st Band Significance for Image Category (ISUBCAT1)		6 BCS spaces (code 0x20)
1st Band Image Filter Condition (IFC1)	N	1 character - required default value
1st Band Standard Image Filter Code (IMFLT1)		3 BCS spaces (code 0x20) - reserved
1st Band Number of LUTS (NLUTS1)	0	1 character
Image Sync Code (ISYNC)	0	1 digit
Image Mode (IMODE)	B	1 character - B required for 1 band
Number of Blocks per Row (NBPR)	0001	4 digits
Number of Blocks per Column (NBPC)	0001	4 digits
Number of pixels Per Block Horizontal (NPPBH)	2050	4 digits

Table C-2-2. Example of the first image subheader (continued)

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
Number of pixels Per Block Vertical (NPPBV)	1332	4 digits
Number of Bits per Pixel (NBPP)	08	2 digits
Display Level (IDLVL)	001	3 characters - minimum value makes this base image
Attachment Level (IALVL)	000	Required 3 digit value since minimum display level.
Location (ILOC)	0000000000	10 characters upper left pixel located at origin of common coordinate system
Image magnification (IMAG)	1.0	3 character followed by a BCS spaces (code 0x20) - 4 characters
User Defined Image Data Length (UDIDL)	00000	5 digits
Extended Subheader Data Length (IXSHDL)	00000	5 digits

†[2] According to the standard - this should look like a single contiguous comment of up to three 80 character blocks.

(1) Explanation of the first image subheader. There are two images in this sample file. The first image has Display Level 001. Its subheader is shown in Table C-2-2. It is an unclassified, single band, single block, grey scale image with 8 bits per pixel and does not have an associated LUT. There are three associated comments. It is visible imagery, does not have geo-location data and is stored as an uncompressed image. It is located at the origin of the common coordinate system within which all the displayable file components are located. It is 1332 rows by 2050 columns. Figure C-2-1 illustrates the image printed at approximately three hundred pixels per inch.

Table C-2-3. Example of the second image subheader

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (IM)	IM	2 characters
Image ID (IID)	Missing ID	10 characters
Image Date & Time (IDATIM)	19960927011729	14 characters
Target ID (TGTID)		17 BCS spaces (code 0x20)
Image Title (ITITLE)	Zoomed Test Facility	18 characters followed by 62 BCS spaces (code 0x20) - 80 characters
Image Security Classification (ISCLAS)	U	1 character
Image Codewords (ISCODE)		40 BCS spaces (code 0x20)
Image Control and Handling (ISCTLH)		40 BCS spaces (code 0x20)
Image Releasing Instructions (ISREL)		40 BCS spaces (code 0x20)

Table C-2-3. Example of the second image subheader (continued)

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
Image Classification Authority (ISCAUT)		20 BCS spaces (code 0x20)
Image Security Control Number (ISCTLN)		20 BCS spaces (code 0x20)
Image Security Downgrade (ISDWNG)		6 BCS spaces (code 0x20) - no downgrade event
Encryption (ENCRYP)	0	Required default
Image Source (ISORCE)	Cut of original image.	22 characters followed by 20 BCS spaces (code 0x20) - 42 characters
Number of Significant Rows in image (NROWS)	00000224	8 characters
Number of Significant Columns in image (NCOLS)	00000400	8 characters
Pixel value type (PVTYPE)	INT	3 characters - interpret pixel values as integers
Image Representation (IREP)	MONO	4 characters followed by 4 BCS spaces (code 0x20) - grey scale imagery
Image Class (ICAT)	VIS	3 characters followed by 5 BCS spaces (code 0x20) - visible imagery
Actual Bits-Per-Pixel Per Band (ABPP)	08	2 digits
Pixel Justification (PJUST)	R	1 character
Image Coordinate System (ICORDS)		Space - indicates no geo location coordinates
Number of Image Comments (NICOM)	0	1 digit
Image Compression (IC)	NC	2 characters - indicates uncompressed
Number of Bands (NBANDS)	1	1 digit
1st Band Representation (IREPBAND1)		2 BCS spaces (code 0x20)
1st Band Significance (ISUBCAT1)		6 BCS spaces (code 0x20)
1st Band Image Filter Condition (IFC1)	N	1 character - required default value
1st Band Standard Image Filter Code (IMFLT1)		3 BCS spaces (code 0x20) - reserved
1st Band Number of LUTS (NLUTS1)	0	1 character
Image Sync Code (ISYNC)	0	1 digit
Image Mode (IMODE)	B	1 character - B required for 1 band
Number of Blocks per Row (NBPR)	0001	4 digits
Number of Blocks per Column (NBPC)	0001	4 digits

Table C-2-3. Example of the second image subheader (continued)

NSIF IMAGE SUBHEADER FIELD	FORMAT	COMMENT
Number of pixels Per Block Horizontal (NPPBH)	0400	4 digits
Number of pixels Per Block Vertical (NPPBV)	0224	4 digits
Number Bits Per Pixel (NBPP)	08	2 digits
Display Level (IDLVL)	002	3 digits
Attachment Level (IALVL)	001	3 digits
Location (ILOC)	0057800142	10 characters, located at row 578 column 142 of base image
Image Magnification (IMAG)	1.0	3 characters followed by a BCS spaces (code 0x20) - 4 characters
User Defined Image Data Length (UDIDL)	00000	5 digits
Extended Subheader Data Length (IXSHDL)	00000	5 digits

(2) Explanation of the second image subheader. This image is the second image in the file. As is the first image, this image is an 8 bit visible, grey scale image. It is much smaller (400 columns x 224 rows) and is not compressed. Also, unlike the first image, it has no associated comment fields, indicated by the fact NICOM = 0. Since it is attached to the base image (IALVL = 001), the ILOC field reveals that this image is located with its upper left corner positioned at Row 578, Column 142 with respect to the upper left corner of the base image. Since it has a display level greater than that of the base image, it will obscure part of the base image when they are both displayed.

c. Explanation of the graphic subheaders.

Table C-2-4. Graphic subheader for the first graphic

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (SY)	SY	2
Graphic ID (SID)	0000000001	10
Graphic Name (SNAME)	HELO PAD RECTANGLE	18 characters followed by 2 BCS spaces (code 0x20) - 20 characters
Graphic Security Classification (SSCLAS)	U	1 character
Graphic Codewords (SSCODE)		40 BCS spaces (code 0x20)
Graphic Control and Handling (SSCTLH)		40 BCS spaces (code 0x20)
Graphic Releasing Instructions (SSREL)		40 BCS spaces (code 0x20)
Graphic Classification Authority (SSCAUT)		20 BCS spaces (code 0x20)
Graphic Security Control Number (SSCTLN)		20 BCS spaces (code 0x20)
Graphic Security Downgrade (SSDWNG)		6 BCS spaces (code 0x20)

Table C-2-4. Graphic subheader for the first graphic (continued)

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
Encryption (ENCRYP)	0	Required default
Graphic Type (STYPE)	C	1 character - indicates CGM
(SRES1)		reserved 13 BCS spaces (code 0x20)
Display Level (SDLVL)	003	3 digits
Attachment Level (SALVL)	001	3 digits
Graphic Location (SLOC)	0039201110	10 characters
First Graphic Bound Location (SBND1)	0039201110	10 characters
Graphic Colour (SCOLOR)	M	indicates CGM file contains no colour components
Second Graphic Bound Location (SBND2)	0051001836	10 characters
(SRES2)		reserved 2 BCS spaces (code 0x20)
Extended Subheader Data Length (SXSHDL)	00000	5 digits

(1) Explanation of the first graphic subheader. This graphic is a computer graphics metafile graphic (HELO PAD RECTANGLE). The graphic is attached to the base image, and its location is recorded in SLOC (row 392, column 1110) and is measured as an offset from the origin at the upper left corner of that image.

Table C-2-5. Graphic subheader for the second graphic

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (SY)	SY	2
Graphic ID (SID)	0000000002	10
Graphic Name (SNAME)	ARROW	5 characters followed by 15 BCS spaces (code 0x20) - 20 characters
Graphic Security Classification (SSCLAS)	U	1 character
Graphic Codewords (SSCODE)		40 BCS spaces (code 0x20)
Graphic Control and Handling (SSCTLH)		40 BCS spaces (code 0x20)
Graphic Releasing Instructions (SSREL)		40 BCS spaces (code 0x20)
Graphic Classification Authority (SSCAUT)		20 BCS spaces (code 0x20)
Graphic Security Control Number (SSCTLN)		20 BCS spaces (code 0x20)
Graphic Security Downgrade (SSDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	Required default
Graphic Type (STYPE)	C	1 character - indicates CGM
(SRES1)	0000	Reserved 13 BCS spaces (code 0x20)

Table C-2-5. Graphic subheader for the second graphic (continued)

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
Display Level (SDLVL)	004	3 digits
Attachment Level (SALVL)	002	3 digits
Graphic Location (SLOC)	0000000285	10 characters relative to origin of second image
First Graphic Bound Location (SBND1)	-022500270	10 characters relative to origin of second image
Graphic Colour (SCOLOR)	M	indicates CGM file contains no colour components
Second Graphic Bound Location (SBND2)	0000000300	10 characters relative to origin of second image
(SRES2)	000	Reserved 2 BCS spaces (code 0x20)
Extended Subheader Data Length (SXSHDL)	00000	5 digits

(2) Explanation of the second graphic subheader. The second graphic is also a CGM graphic. It is the arrow pointing to the test facility. It is attached to the subimage. Therefore, its location as recorded in SLOC is measured as an offset from the upper left corner of the subimage.

Table C-2-6. Graphic subheader for the third graphic

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (SY)	SY	2
Graphic ID (SID)	0000000003	10
Graphic Name (SNAME)	HQ BUILDING	11 characters followed by 9 BCS spaces (code 0x20) - 20 characters
Graphic Security Classification (SSCLAS)	U	1 character
Graphic Codewords (SSCODE)		40 BCS spaces (code 0x20)
Graphic Control and Handling (SSCTLH)		40 BCS spaces (code 0x20)
Graphic Releasing Instructions (SSREL)		40 BCS spaces (code 0x20)
Graphic Classification Authority (SSCAUT)		20 BCS spaces (code 0x20)
Graphic Security Control Number (SSCTLN)		20 BCS spaces (code 0x20)
Graphic Security Downgrade (SSDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	Required default
(SRES1)		Reserved 13 BCS spaces (code 0x20)
Display Level (SDLVL)	005	3 digits
Attachment Level (SALVL)	001	3 digits
Graphic Location (SLOC)	0000000000	10 characters

Table C-2-6. Graphic subheader for the third graphic (continued)

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
First Graphic Bound Location (SBND1)	0062501710	10 characters
Graphic Colour (SCOLOR)	M	indicates CGM file contains no colour components
Second Graphic Bound Location (SBND2)	0070502010	10 characters
(SRES2)	000	Reserved 2 BCS spaces (code 0x20)
Extended Subheader Data Length (SXSHDL)	00000	5 digits

(3) Explanation of the third graphic subheader. The third graphic is a CGM annotation (HQ Building). It is attached to the base image. Its location as recorded in SLOC is measured as an offset from the upper left corner of the base image, in this case SLOC is 0,0 and the offsetting for this graphic is actually done within the CGM construct itself.

Table C-2-7. Graphic subheader for the fourth graphic

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (SY)	SY	2
Graphic ID (SID)	0000000004	10
Graphic Name (SNAME)	MAJOR TEST FACILITY	19 characters followed by 1 BCS space (code 0x20) - 20 characters
Graphic Security Classification (SSCLAS)	U	1 character
Graphic Codewords (SSCODE)		40 BCS spaces (code 0x20)
Graphic Control and Handling (SSCTLH)		40 BCS spaces (code 0x20)
Graphic Releasing Instructions (SSREL)		40 BCS spaces (code 0x20)
Graphic Classification Authority (SSCAUT)		20 BCS spaces (code 0x20)
Graphic Security Control Number (SSCTLN)		20 BCS spaces (code 0x20)
Graphic Security Downgrade (SSDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	Required default
Graphic Type (STYPE)	C	1 character - indicates CGM
(SRES1)		Reserved 13 BCS spaces (code 0x20)
Display Level (SDLVL)	006	3 digits
Attachment Level (SALVL)	002	3 digits
Graphic Location (SLOC)	0008500415	10 characters relative to origin of second image
First Graphic Bound Location (SBND1)	0008500415	10 characters relative to origin of second image

Table C-2-7. Graphic subheader for the fourth graphic (continued)

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
Graphic Colour (SCOLOR)	M	indicates CGM file contains no colour components
Second Graphic Bound Location (SBND2)	0011500755	10 characters relative to origin of second image
(SRES2)	000	Reserved 2 BCS spaces (code 0x20)
Extended Subheader Data Length (SXSHDL)	00000	5 digits

(4) Explanation of the fourth graphic subheader. The fourth graphic is a CGM graphic. It is the MAJOR TEST FACILITY text. It is attached to the subimage. Therefore, its location as recorded in SLOC is measured as an offset from the upper left corner of the subimage.

Table C-2-8. Graphic subheader for the fifth graphic

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (SY)	SY	2
Graphic ID (SID)	0000000005	10
Graphic Name (SNAME)	COMMUNICATION ARROW	19 characters followed by 1 BCS space (code 0x20) - 20 characters
Graphic Security Classification (SSCLAS)	U	1 character
Graphic Codewords (SSCODE)		40 BCS spaces (code 0x20)
Graphic Control and Handling (SSCTLH)		40 BCS spaces (code 0x20)
Graphic Releasing Instructions (SSREL)		40 BCS spaces (code 0x20)
Graphic Classification Authority (SSCAUT)		20 BCS spaces (code 0x20)
Graphic Security Control Number (SSCTLN)		20 BCS spaces (code 0x20)
Graphic Security Downgrade (SSDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	Required default
Graphic Type (STYPE)	C	1 character - indicates CGM
(SRES1)		Reserved 13 BCS spaces (code 0x20)
Display Level (SDLVL)	007	3 digits
Attachment Level (SALVL)	001	3 digits
Graphic Location (SLOC)	0047000040	10 characters
First Graphic Bound Location (SBND1)	0047000040	10 characters
Graphic Colour (SCOLOR)	M	indicates CGM file contains no colour components

Table C-2-8. Graphic subheader for the fifth graphic (continued)

NSIF GRAPHIC SUBHEADER FIELD	FORMAT	COMMENT
Second Graphic Bound Location (SBND2)	0059000600	10 characters
(SRES2)	000	Reserved 2 BCS spaces (code 0x20)
Extended Subheader Data Length (SXSHDL)	00000	5 digits

(5) Explanation of the fifth graphic subheader. The fifth graphic is a CGM graphic. It is the COMMUNICATIONS NODE annotation with associated arrow It is attached to the base image. Therefore, its location as recorded in SLOC is measured as an offset from the upper left corner of the base image.

d. Explanation of the text subheaders. There are 5 text documents included in the file. Other than the text data they contain, they differ only in matters such as title, date-time of creation, and ID. Therefore, only the first is discussed, since the subheaders of all the rest are essentially the same.

Table C-2-9. Text subheader for the text document

NSIF TEXT SUBHEADER FIELD	FORMAT	COMMENT
File Part Type (TE)	TE	2 characters
Text ID (TEXTID)	0000000001	10 characters
Text Date & Time (TXTDT)	19960930224530	14 characters
Text Title (TXTITL)	First sample text file.	22 characters followed by 58 BCS spaces (code 0x20) - 80 characters
Text Security Classification (TSCLAS)	U	1 character
Text Codewords (TSCODE)		40 BCS spaces (code 0x20)
Text Control and Handling (TSCTLH)		40 BCS spaces (code 0x20)
Text Releasing Instructions (TSREL)		40 BCS spaces (code 0x20)
Text Classification Authority (TSCAUT)		20 BCS spaces (code 0x20)
Text Security Control Number (TSCTLN)		20 BCS spaces (code 0x20)
Text Security Downgrade (TSDWNG)		6 BCS spaces (code 0x20)
Encryption (ENCRYP)	0	1 character - required default
Text Format (TXTFMT)	STA	3 characters
Extended Subheader Data Length (TXSHDL)	00000	5 digits

(1) Explanation of the first text subheader. The first text document is unclassified and was created on September 30, 1996 at 22:45 hours. Its subheader is shown in Table C-2-9.

APPENDIX 3 TO ANNEX C. IMPLEMENTATION CONSIDERATIONS

GENERAL

This appendix contains general or explanatory information that may be helpful but is not mandatory.

1. NSIF implementation guidelines. The NATO Secondary Imagery Format (NSIF) has been developed to provide image exchange capabilities among computer systems of various designs and capabilities. This appendix will discuss general considerations pertinent to successful implementation of the NSIF. Guidelines will be presented, and potential problems will be highlighted. The NSIF pre-processor and post-processor software, the software necessary to write and read a NSIF file based on host files containing the data items to be included, are to be written by the user. The combination of the pre-processor and post-processor hereafter will be referred to as the "NSIF implementation." Pre-processing is sometimes called "packing," and post-processing is called "unpacking." NSIF implementation sample software is available through your point of contact.

GENERAL REQUIREMENTS

2. Scope of NSIF implementation. NSIF describes the format of images and graphics and text within the NSIF file only. It does not define the image or text requirements of the host system. The host system is responsible for the handling of unpacked image and text files, as well as image and text display capabilities.

3. Creating headers and subheaders. This standard specifies legal values for the header and subheader fields. The NSIF pre-processor for any particular host system will be responsible for enforcing the field values as stated in this standard.

4. Character counts. The NSIF uses explicit byte counts to delimit fields. No end-of-field characters are used. These byte counts are critical for the proper interpretation of a NSIF file. The NSIF pre-processor should compute these byte counts based on file contents to insure accuracy. All fields in the NSIF file header and subheaders must be present exactly as specified in the NSIF file header and subheader descriptions, and no additional fields may be inserted. The NSIF uses various conditional fields whose presence is determined by previous fields and counts. If an expected conditional field is missing, the remainder of the file will be misinterpreted. A similar result will occur if a conditional field is inserted when it is not required. For these reasons, the item count fields are critical, and every effort must be made to ensure their accuracy. The NSIF pre-processor should compute these item counts based on file contents whenever possible.

5. Data entry. To reduce any operator workload imposed by the pre-processor, each pre-processor should provide for the automatic entry of data. Global default values for the particular NSIF version should be inserted automatically in the file. System default values, such as the standard size parameters for a base image, also should be entered automatically by the pre-processor. Values that are known to the system, such as the time or the computed size of an overlay, also should be entered automatically.

6. User defined header and user defined image subheader data. Users may need to add additional data to a NSIF file header or image subheader. To accommodate this requirement, user defined data fields are provided in the file header and image subheader. One potential use for the user defined image subheader data is to provide space for directly associating acquisition parameters with the image. Use of these fields requires insertion of tagged records that implement the extension as described in this standard. Before use, tags shall be registered with Custodian according to procedures available from the Custodian. This procedure ensures that different users will not use the same tag to flag different extended data. It also provides for configuration management of tagged record formats where the extended data are expected to be used by a wide audience of users.

a. Handling the extended headers and subheaders. The NSIF has made allowances for future enhancements by defining extended headers and subheaders, the contents of which are under configuration control. These fields should not be used except as provided for in documentation available from the Custodian. These extended headers are composed of an extended header byte count and extended header data. The extended header count must be extracted by the software, and the appropriate number of extended header bytes must be read or bypassed. Five extended headers are in the current NSIF format under configuration control. They are the Extended Header Data (XHD) in the NSIF Header and the Extended Subheaders in the Image (IXSHD), Graphic (SXSHD), and Text (TXSHD) Subheaders. The NSIF also has made allowances for extended headers that are under user control by providing the User Defined Header Data (UDHD) field in the NSIF Header and the User Defined Image Data (UDID) field in the Image Subheader. Use of these fields must be coordinated with the Custodian by tag registration, but it is not under configuration management. Implementors are reminded that these extended headers also must be handled properly (skip over them if there are no means to interpret them properly).

7. Out-of-bounds field values. The file creator is responsible for ensuring that all NSIF field values are within the bounds specified by the NSIF document. An out-of-bounds value in a NSIF field indicates that either an error occurred or that the sending station was not in full compliance with NSIF.

8. Use of images in NSIF. The NSIF specifies a format for images contained within a NSIF file only. A NSIF implementation must be capable of translating this format to and from the host systems local format. Some host systems have multiple formats for binary data. In these cases, the NSIF implementation must use the appropriate host format to provide the necessary data exchange services with other system packages. When imagery data of N bits-per-pixel is displayed on an M-bit (2^M grey shades) display device (N<M), it must be transformed into the dynamic range of the device. One way to do this is to modify the LUTs of the display device. However, if M-bit and N-bit imagery is displayed simultaneously, the M-bit image will appear distorted. The recommended method is to convert the N-bit imagery into M-bit imagery, then use the standard LUTs. The following equation will transform a N-bit pixel into an M-bit pixel:

M	=	number of bits-per-pixel of display device
N	=	number of bits-per-pixel of image (ABPP) where N<M
P_N	=	N-bit pixel value
P_M	=	M-bit pixel value

$$P_M = \frac{2^M - 1}{2^N - 1} P_N$$

9. Use of text files in the NSIF. The text format field is provided to help the reader of the file determine how to interpret the text data received. The file reader is responsible for interpreting the various text formats. Format designations explicitly supported by the NSIF are as follows:

a. NSIF BCS. NSIF BCS is a special format to provide a common format for all NSIF implementations. The BCS code shall be represented as depicted in Tables C-3-1 and C-3-2. This is the BCS code represented in ISO/IEC 10646-1. The BCS codes shall be seven bits, a_1 through a_7 with an eighth bit added. The eighth bit, a_8, shall be set to 0. A_8 shall be the Most Significant Bit (MSB), and a_1 shall be the Least Significant Bit (LSB). It is intended to provide for simple communications among NSIF stations. The NSIF BCS format is comprised of the following BCS characters (all numbers are decimal): Line Feed (10), Form Feed (12), Carriage Return (13), and space (32) through tilde (126). This set includes all the alphanumeric characters as well as all commonly used punctuation characters. All lines within a NSIF BCS test segment will be separated by carriage return/line feed pairs. It is the responsibility of the local system to translate these pairs into the local format. NSIF BCS has no standard line length. The host system must be capable of processing lines that are longer than the local standard. For NSIF headers and subheaders, BCS codes are further restrained:

(1) BCS-N (Numeric format) The range of allowable characters for BCS-N consists of the numbers ‘0’ through ‘9’ from the BMP block named ‘BASIC LATIN’, codes 0x30 through 0x39 and the following:

Slant bar	code 0x2F
Plus	code 0x2B
Minus	code 0x2D
Decimal point	code 0x2E

(2) BCS-A (Alphanumeric format) The range of allowable characters for BCS-A consists of the following:

Space through Tilde codes 0x20 through 0x7E (BMP block ‘BASIC LATIN’)

b. Other. "Other" will allow allISO/IEC 10646-1 codes to be used. Different systems interpret these codes for various purposes. This format should be restricted to uses where the receiving and transmitting stations have agreed beforehand what the format represents.

Table C-3-1. Basic Latin character set

	000	001	002	003	004	005	006	007
0	000	016	SP 032	0 048	@ 064	P 080	` 096	p 112
1	001	017	! 033	1 049	A 065	Q 081	a 097	q 113
2	002	018	“ 034	2 050	B 066	R 082	b 098	r 114
3	003	019	# 035	3 051	C 067	S 083	c 099	s 115
4	004	020	$ 036	4 052	D 068	T 084	d 100	t 116
5	005	021	% 037	5 053	E 069	U 085	e 101	u 117
6	006	022	& 038	6 054	F 070	V 086	f 102	v 118
7	007	023	‘ 039	7 055	G 071	W 097	g 103	w 119
8	008	024	(040	8 056	H 072	X 088	h 104	x 120
9	009	025	) 042	9 057	I 073	Y 089	i 1005	y 121
A	010	026	* 042	: 058	J 074	Z 090	j 106	z 122
B	011	027	+ 043	; 059	K 075	[091	k 107	{ 123
C	012	028	‘ 044	< 060	L 076	\ 092	1 108	¤ 124
D	013	029	- 045	= 061	M 077	] 093	m 109	} 125
E	014	030	. 046	> 062	N 078	^ 094	n 110	~ 126
F	015	031	/ 047	? 063	O 079	_ 095	o 111	128

Table C-3-2. Latin supplement character set

	008	009	00A	00B	00C	00D	00E	00F
0	128	144	NB SP 160	° 176	À 192	Ð 208	à 224	ð 240
1	129	145	¡ 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	130	146	¢ 162	² 178	Â 194	Ò 210	â 226	ò 242
3	131	147	£ 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	132	148	¤ 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	133	149	¥ 165	µ 181	Å 197	Õ 213	å 229	õ 245
6	134	150	¦ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	135	151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	136	152	¨ 168	¸ 184	È 200	Ø 216	è 232	ø 248
9	137	153	© 169	¹ 185	É 201	Ù 217	é 233	ù 249
A	138	154	ª 170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	139	155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	140	156	¬ 172	¼ 188	Ì 204	Ü 220	ì 236	ü 252
D	141	157	- 173	½ 189	Í 205	Ý 221	í 237	ý 253
E	142	158	® 174	¾ 190	Î 206	Þ 222	î 238	þ 254
F	143	159	¯ 175	¿ 191	Ï 207	ß_ 223	ï 239	ÿ 255

Table C-3-3. Basic Latin character set explanation

Decimal	Hex	Name
032	20	SPACE
033	21	EXCLAMATION MARK
034	22	QUOTATION MARK
035	23	NUMBER SIGN
036	24	DOLLAR SIGN
037	25	PERCENT SIGN
038	26	AMPERSAND
039	27	APOSTROPHE
040	28	LEFT PARENTHESIS
041	29	RIGHT PARENTHESIS
042	2A	ASTERISK
043	2B	PLUS SIGN
044	2C	COMMA
045	2D	HYPHEN-MINUS
046	2E	FULL STOP
047	2F	SOLIQUS
048	30	DIGIT ZERO
049	31	DIGIT ONE
050	32	DIGIT TWO
051	33	DIGIT THREE
052	34	DIGIT FOUR
053	35	DIGIT FIVE
054	36	DIGIT SIX
055	37	DIGIT SEVEN
056	38	DIGIT EIGHT
057	39	DIGIT NINE
058	3A	COLON
059	3B	SEMICOLON
060	3C	LESS-THAN SIGN
061	3D	EQUALS SIGN
062	3E	GREATER-THAN SIGN
063	3F	QUESTION MARK
064	40	COMMERCIAL AT
065	41	LATIN CAPITAL LETTER A
066	42	LATIN CAPITAL B
067	43	LATIN CAPITAL C
068	44	LATIN CAPITAL D
069	45	LATIN CAPITAL E
070	46	LATIN CAPITAL F
071	47	LATIN CAPITAL G
072	48	LATIN CAPITAL H
073	49	LATIN CAPITAL I
074	4A	LATIN CAPITAL J
075	4B	LATIN CAPITAL K
076	4C	LATIN CAPITAL L
077	4D	LATIN CAPITAL M
078	4E	LATIN CAPITAL N
079	4F	LATIN CAPITAL O
080	50	LATIN CAPITAL P
081	51	LATIN CAPITAL Q
082	52	LATIN CAPITAL R
083	53	LATIN CAPITAL S
084	54	LATIN CAPITAL T
085	55	LATIN CAPITAL U

Table C-3-3. Basic Latin character set explanation (continued)

Decimal	Hex	Name
086	56	LATIN CAPITAL V
087	57	LATIN CAPITAL W
088	58	LATIN CAPITAL X
089	59	LATIN CAPITAL Y
090	5A	LATIN CAPITAL Z
091	5B	LEFT SQUARE BRACKET
092	5C	REVERSE SOLIDUS
093	5D	RIGHT SQUARE BRACKET
094	5E	CIRCUMFLEX ACCENT
095	5F	LOW LINE
096	60	GRAVE ACCENT
097	61	LATIN SMALL LETTER A
098	62	LATIN SMALL LETTER B
099	63	LATIN SMALL LETTER C
100	64	LATIN SMALL LETTER D
101	65	LATIN SMALL LETTER E
102	66	LATIN SMALL LETTER F
103	67	LATIN SMALL LETTER G
104	68	LATIN SMALL LETTER H
105	69	LATIN SMALL LETTER I
106	6A	LATIN SMALL LETTER J
107	6B	LATIN SMALL LETTER K
108	6C	LATIN SMALL LETTER L
109	6D	LATIN SMALL LETTER M
110	6E	LATIN SMALL LETTER N
111	6F	LATIN SMALL LETTER O
112	70	LATIN SMALL LETTER P
113	71	LATIN SMALL LETTER Q
114	72	LATIN SMALL LETTER R
115	73	LATIN SMALL LETTER S
116	74	LATIN SMALL LETTER T
117	75	LATIN SMALL LETTER U
118	76	LATIN SMALL LETTER V
119	77	LATIN SMALL LETTER W
120	78	LATIN SMALL LETTER X
121	79	LATIN SMALL LETTER Y
122	7A	LATIN SMALL LETTER Z
123	7B	LEFT CURLY BRACKET
124	7C	VERTICAL LINE
125	7D	RIGHT CURLY BRACKET
126	7E	TILDE

Table C-3-4. Latin Supplement character set explanation

Decimal	Hex	Name
160	A0	NO BREAK SPACE
161	A1	INVERTED EXCLAMATION MARK
162	A2	CENT SIGN
163	A3	POUND SIGN
164	A4	CURRENCY SIGN
165	A5	YEN SIGN
166	A6	BROKEN BAR
167	A7	SECTION SIGN
168	A8	DIAERESIS
169	A9	COPYRIGHT
170	AA	FEMININE ORDINAL INDICATOR
171	AB	LEFT-POINTING DOUBLE ANGLE QUOTATION MARK
172	AC	NOT SIGN
173	AD	SOFT HYPHEN
174	AE	REGISTERED SIGN
175	AF	MACRON
176	B0	DEGREE SIGN
177	B1	PLUS-MINUS SIGN
178	B2	SUPERSCRIPT TWO
179	B3	SUPERSCRIPT THREE
180	B4	ACUTE ACCENT
181	B5	MICRO SIGN
182	B6	PILCROW SIGN
183	B7	MIDDLE DOT
184	B8	CEDILLA
185	B9	SUPERSCRIPT ONE
186	BA	MASCULINE ORDINAL INDICATOR
187	BB	RIGHT POINTING DOUBLE ANGLE QUOTATION MARK
188	BC	VULGAR FRACTION ONE QUARTER
189	BD	VULGAR FRACTION ONE HALF
190	BE	VULGAR FRACTION THREE QUARTERS
191	BF	INVERTED QUESTION MARK
192	C0	LATIN CAPITAL LETTER A WITH GRAVE
193	C1	LATIN CAPITAL LETTER A WITH ACUTE
194	C2	LATIN CAPITAL LETTER A WITH CIRCUMFLEX
195	C3	LATIN CAPITAL LETTER A WITH TILDE
196	C4	LATIN CAPITAL LETTER A WITH DIAERESIS
197	C5	LATIN CAPITAL LETTER A WITH RING ABOVE
198	C6	LATIN CAPITAL LIGATURE AE
199	C7	LATIN CAPITAL LETTER C WITH CEDILLA
200	C8	LATIN CAPITAL LETTER E WITH GRAVE
201	C9	LATIN CAPITAL LETTER E WITH ACUTE
202	CA	LATIN CAPITAL LETTER E WITH CIRCUMFLEX
203	CB	LATIN CAPITAL LETTER E WITH DIAERESIS
204	CC	LATIN CAPITAL LETTER I WITH GRAVE
205	CD	LATIN CAPITAL LETTER I WITH ACUTE
206	CE	LATIN CAPITAL LETTER I WITH CIRCUMFLEX
207	CF	LATIN CAPITAL LETTER I WITH DIAERESIS
208	D0	LATIN CAPITAL LETTER ETH (ICELANDIC)
209	D1	LATIN CAPITAL N WITH TILDE
210	D2	LATIN CAPITAL LETTER O WITH GRAVE
211	D3	LATIN CAPITAL LETTER O WITH ACUTE
212	D4	LATIN CAPITAL LETTER O WITH CIRCUMFLEX
213	D5	LATIN CAPITAL LETTER O WITH TILDE

Table C-3-4. Latin Supplement character set explanation (continued)

Decimal	Hex	Name
214	D6	LATIN CAPITAL LETTER O WITH DIAERESIS
215	D7	MULTIPLICATION SIGN
216	D8	LATIN CAPITAL LETTER WITH STROKE
217	D9	LATIN CAPITAL LETTER U WITH GRAVE
218	DA	LATIN CAPITAL LETTER U WITH ACUTE
219	DB	LATIN CAPITAL LETTER U WITH CIRCUMFLEX
220	DC	LATIN CAPITAL LETTER U WITH DIAERESIS
221	DD	LATIN CAPITAL LETTER Y WITH ACUTE
222	DE	LATIN CAPITAL LETTER THORN (ICELANDIC)
223	DF	LATIN SMALL LETTER SHARP S (GERMAN)
224	E0	LATIN SMALL A WITH GRAVE
225	E1	LATIN SMALL LETTER A WITH ACUTE
226	E2	LATIN SMALL LETTER A WITH CIRCUMFLEX
227	E3	LATIN SMALL LETTER A WITH TILDE
228	E4	LATIN SMALL LETTER A WITH DIAERESIS
229	E5	LATIN SMALL LETTER A WITH RING ABOVE
230	E6	LATIN SMALL LIGATURE AE
231	E7	LATIN SMALL LETTER C WITH CEDILLA
232	E8	LATIN SMALL LETTER E WITH GRAVE
233	E9	LATIN SMALL LETTER E WITH ACUTE
234	EA	LATIN SMALL LETTER E WITH CIRCUMFLEX
235	EB	LATIN SMALL LETTER E WITH DIAERESIS
236	EC	LATIN SMALL LETTER I WITH GRAVE
237	ED	LATIN SMALL LETTER I WITH ACUTE
238	EE	LATIN SMALL LETTER I WITH CIRCUMFLEX
239	EF	LATIN SMALL LETTER I WITH DIAERESIS
240	F0	LATIN SMALL LETTER ETH (ICELANDIC)
241	F1	LATIN SMALL LETTER N WITH TILDE
242	F2	LATIN SMALL LETTER O WITH GRAVE
243	F3	LATIN SMALL LETTER O WITH ACUTE
244	F4	LATIN SMALL LETTER O WITH CIRCUMFLEX
245	F5	LATIN SMALL LETTER O WITH TILDE
246	F6	LATIN SMALL LETTER O WITH DIAERESIS
247	F7	DIVISION SIGN
248	F8	LATIN SMALL LETTER O WITH STROKE
249	F9	LATIN SMALL LETTER U WITH GRAVE
250	FA	LATIN SMALL LETTER U WITH ACUTE
251	FB	LATIN SMALL LETTER U WITH CIRCUMFLEX
252	FC	LATIN SMALL LETTER U WITH DIAERESIS
253	FD	LATIN SMALL LETTER Y WITH ACUTE
254	FE	LATIN SMALL LETTER THORN (ICELANDIC)
255	FF	LATIN SMALL LETTER Y WITH DIAERESIS

10. File system constraints. A NSIF file is presented as a stream of contiguous bytes. This format may not be suitable for some file systems. The translation of files to and from the local file format for a system should be examined for potential incompatibilities before an implementation is attempted.

11. Security considerations. A NSIF file contains sufficient security information in the file header, image and graphic subheaders to allow implementors to meet virtually any security requirement for displaying classification data. Exact security information handling requirements generally are specified by appropriate accreditation authorities or specific user requirements. It is suggested that implementors extract the classification data from one or more of the header/subheaders and ensure that the information is always displayed whenever the pertinent part of the NSIF file is displayed.

APPENDIX 4TO ANNEX C. SAMPLE NSIF FILE STRUCTURE

The following is an example of handling a file that has control tags with overflow, file has a single image.

Table C-4-1. Sample NSIF file structure

NSIF FILE HEADER	IMAGE SUBHEADER	IMAGE DATA	DATA EXTENSION SUBHEADER	DATA EXTENSION

	MAIN NSIF HEADER																	IMAGE SUBHEADER								DES SUBHEADER				
FIELD NAME	FHDR	CLEVEL	ETC	FL	HL	NUMI	LISH001	LI001	NUMS	NUML	NUMT	NUMDES	LDSH001	LD001	NUMRES	UDHDL	XHDL	IM	ETC	IMAG	UDIDL	IXSHDL	IXSOFL	IXSHD	IMAGE DATA	DE	DESTAG	ETC	DESOFLW	DESITEMDESSHL DATA EXTENSION SEG 42000
BYTES	9	2		1	6	3	6	10	3	3	3	3	4	9	3	5	5	2		4	5	5	3	TAG DATA		2	25		6	34
FIELD VALUE	NSIF01.00	06		0000805075764	000417	001	098442	0084934656	000	000	000	001	0249	000042000	000	00000	00000	IM		1.0	00000	98003	001	98000		DE	CONTROLLED EXTENSIONS		UDID	0010000

TAG 1 (32,000 BYTES)	TAG 2 (27,000 BYTES)	TAG 3 (39,000 BYTES)	TAG 4 (42,000 BYTES)

Note: Capacity of IXSHD is 99,999 bytes, you cannot split a tag, therefore the first 3 tags fit into the IXSHD and the 4th tag is overflowed into the Data Extension Area.

APPENDIX 5 TO ANNEX C. PRODUCT CONFIGURATIONS

INTRODUCTION

This appendix contains general or explanatory information that may be helpful, but is not mandatory.

1. General. The NSIF provides a very flexible means to package imagery products. One of the main objectives of NSIF is to provide increased interoperability among potentially disparate imagery systems. For the purposes of NSIF, interoperability means the ability to exchange NSIF formatted imagery products among NSIF capable systems in a manner that is meaningful and useful to the end users. This places a significant burden on NSIF read capable implementations to be able to interpret and use potentially any combination of NSIF file format options that may be created by NSIF file producers. Consequently, significant care should be taken when defining product specifications for NSIF formatted imagery products.

2. Purpose. The objective of the following discussion is to describe several generalised product configurations that can be used as the basis for defining specific imagery products. These product configurations are typical of those successfully used within the imagery and mapping community to date.

NSIF PRODUCT CONFIGURATIONS

3. General. An imagery product may potentially be produced under one of the following concepts:

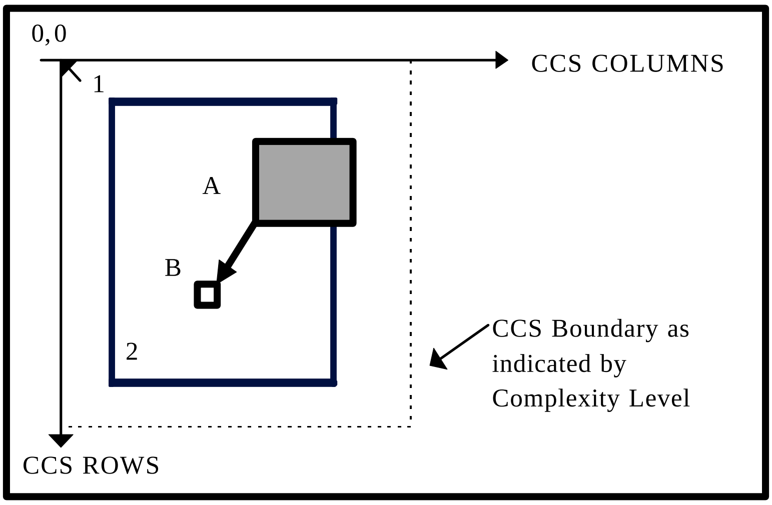
a. Single file, single base image. This is the most common use of the NSIF format. In this product concept, the NSIF file is produced with a focus on a single image, commonly called the ‘base image’. All other segments and extended data within the file are focused on amplifying the information portrayed in the base image.

b. Single file, multiple images. In this product concept, the NSIF file is produced containing multiple images, all of which have equal or similar significance to the value of the product. Other segments and extended data within the file are focused on amplifying the information portrayed in the image(s) to which they are associated.

c. Single file, no image. This type of product may only have graphic segments, or only text segments, or only extension segments, or any combination of these segments. The significance of the data within the file may pertain only to that file, or it may pertain to one or more files with which it is associated.

d. Multiple correlated files. For this product concept, the product is comprised of multiple NSIF files that are interrelated as explicitly defined in the product specification.

4. Single file, single base image. For this type of product file, there is one image of central focus, the base image, placed on the Common Coordinate System (CCS) plane. Its first pixel may be located at the origin (0,0) of the CCS, or off-set from the CCS origin according to the row/column coordinate values placed in the location (LOC) field of the image subheader. Figure C-5-1 provides a representative portrayal for the following discussion.



1. Common Coordinate System Origin (0,0)
2. Image DL = 100 AL = 000 ILOC = 45,50
A. Image DL = 110 AL = 100 ILOC = 50,300
B. Graphic DL = 120 AL = 110 ILOC = 250,-100 (Box & Arrow)

Figure C-5-1. Single file, single base image

a. Image segment overlays. Additional images, often called subimages or inset images, may be included as separate image segments in the file. The purpose of these images is to add information or clarity about the base image. Their placement in the CCS plane is controlled by the value of each segment's Attachment Level (AL) and Location (LOC) row/column value. When overlay images are attached to the base image, the LOC value represents a row/column off-set in the CCS from the location specified by the base image row/column LOC value. If the overlay image is unattached to any other segment (AL=000), the overlay's LOC value is a row/column off-set from the CCS origin (0,0).

b. Graphic segment overlays. Graphic Segments are used to provide graphical (lines, polygons, ellipses, etc.) and textual annotation to the base image. The graphic representation is done using Computer Graphics Metafile (CGM). In a manner similar to image segment overlays, the placement of graphics in the CCS plane is controlled by the value of each segment's AL and LOC values. CGM has its own internal Cartesian coordinate space called "Virtual Display Coordinates (VDC)" that has its own defined origin (0,0) point. The row/column value in the graphic segment LOC field identifies the placement of the graphic's VDC origin point relative to the CCS origin when AL=000, or relative to the segment LOC to which it is attached.

c. Non-destructive overlays. NSIF image and graphic segment overlays are handled in a non-destructive manner. The overlays may be placed anywhere within the bounds of the CCS (defined for a specific NSIF file by the Complexity level (CLEVEL)). They may be placed totally on the base image, partially on the base image, or entirely off of the base image. Any image or graphic segment can be placed on or under any other segment, fully or partially. The visibility of pixel values of overlapping segments is determined by the Display Level (DL) assigned to that segment. Each displayable segment (images and graphics) is assigned a DL (ranging from 001 - 999) that is unique within the file. At any CCS pixel location shared by more than one image or graphic, the visible pixel value is the one from the segment having the greatest DL value. If the user of a NSIF file opts to move an overlay, or turn off the presentation of an overlay, the next greatest underlying pixel value(s) will then become visible. This approach allows for the non-destructible nature of NSIF overlays as opposed to the 'burned in' approach where overlay pixel values are used to replace pixels values of the underlying image.

d. Text segments. Text segments allow inclusion in the NSIF file of textual information related to the base image, perhaps a textual description of the activities portrayed in the image.

e. Extension data. The NSIF file header and each standard data type subheader have designated expandable fields to allow for the optional inclusion of extension data. The inclusion of extension data provides the ability to add data/information about the standard data type (metadata) that is not contained in the basic fields of the headers and subheaders. The additional data is contained within one or more NSIF tagged record extensions that are placed in the appropriate field (user defined data field or extended data field) of the standard data type subheader for which the metadata applies. When tagged record extensions have application across multiple data types in the file, or otherwise apply to the entire NSIF file in general, they are placed in the appropriate file header fields. Whereas general purpose NSIF readers should always be able to portray image and graphic segments and act on standard header and subheader data, they may not always be able to act on product specific extension data. Upon receipt of a file that contains extension data, a NSIF compliant system should at least ignore the extensions and properly interpret the other legal components of the NSIF file. Exemplary use of tagged record extensions:

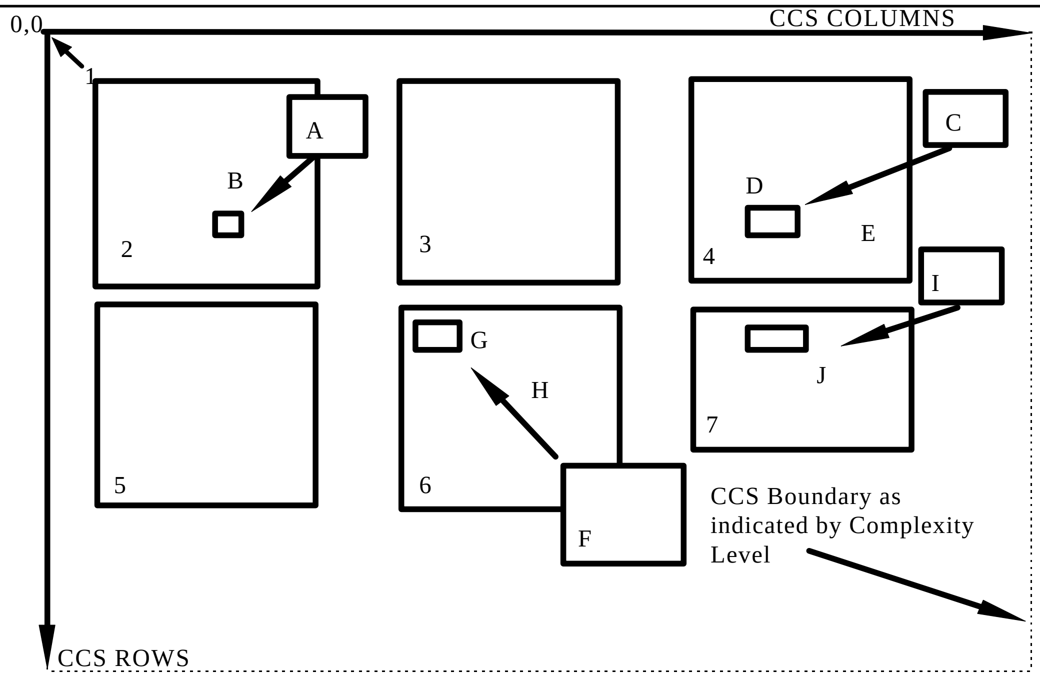
(1) Data about people, buildings, places, landmarks, equipment or other objects that may appear in the image.

(2) Data to allow correlation of information among multiple images and annotations within a NSIF file.

(3) Data about the equipment settings used to obtain the digital image, XRAY, etc.

(4) Data to allow geo-positioning of items in the imagery or measurement of distances of items in the imagery

5. Single file, multiple images. For this type of product file, multiple images of equal or similar focus (multiple 'base' images) are placed within the Common Coordinate System (CCS) plane. Each image is located at an off-set from the CCS origin such that there is no overlap among the images. The Complexity Level of the file must be chosen such that the bounds of the CCS for the file are sufficient to contain the extent of all segments within the file. Figure C-5-2 provides a representative portrayal for this product type. NSIF packer application users need to be aware that the ILOC field may not be large enough to place unattached images everywhere in the CCS. However, attached images can be positioned over the entire CCS.



	DISPLAY LEVEL	ATTACHMENT LEVEL	LOCATION
1. Common Coordinate System Origin (0,0)			
2. Image	DL=100	AL=000	50, 50
(A) Image Segment Overlay	DL=110	AL=100	50, 300
(B) Graphic Overlay (CGM Rectangle & Arrow)	DL=120	AL=110	50, 225
3. Image	DL=200	AL=000	50, 550
4. Image	DL=300	AL=000	50, 1050
(C) Image Segment Overlay	DL=310	AL=300	100, 450
(D) Graphic Segment Overlay (CGM Rectangle)	DL=320	AL=300	300, 75
(E) Graphic Segment Overlay (CGM Arrow)	DL=330	AL=300	150, 100
5. Image	DL=400	AL=000	800, 50
6. Image	DL=500	AL=000	800, 550
(F) Image Segment Overlay	DL=510	AL=500	300, 250
(G) Graphic Segment Overlay (CGM Rectangle)	DL=520	AL=500	35, 35
(H) Graphic Segment Overlay (CGM Arrow)	DL=530	AL=500	125, 125
7. Image	DL=600	AL=000	820, 1050
(I) Image Segment Overlay	DL=610	AL=600	-150, 400
(J) CGM Graphic Overlay (Rectangle & Arrow)	DL=620	AL=600	50, 100

Figure C-5-2. Single file, multiple images

a. Overlays. Each image may be overlaid with additional image and graphic segments in the same fashion as described for the single file, single image case above. All overlays associated with a specific image should be attached to that specific image. Display Levels assigned to each image and graphic in the file must be unique within the file.

b. Text segments. Each text segment should be clearly marked as to whether it applies to the file as a whole, or if it is associated with specific images within the file.

c. Extension data. Tagged record extensions are placed in the file header extension fields when applicable to the file as a whole. Extensions specific to a segment are placed in that segment's subheader.

6. Single file, no image. A NSIF single file product does not always contain an image. It could contain one or more graphic segments, one or more text segments, one or more extension segments, or any combination of these non-image segments. The file may be useful as a stand alone product, or it may be intended for use in conjunction with other NSIF

files. For example, the file could contain graphic overlays to be merged with or applied to another NSIF file that was pre-positioned or transmitted at an earlier time. Any general purpose NSIF reader should at least be able to interpret and render the standard segments of no image NSIF files on a stand alone basis.

7. Multiple correlated files. An imagery product may be comprised of multiple NSIF files that are interrelated in a specified manner. This approach vastly increases the potential combination and permutation of options a general purpose NSIF reader would need to support to maintain full interpret capability. Therefore, each NSIF file in a multiple correlated file set must be structured such that a general purpose NSIF reader can properly interpret and render the file as if it were a stand alone product. The correlation of multiple NSIF files in a single product must be explicitly and unambiguously defined in a product specification. NSIF readers can then be further categorised according to specific multiple file product specifications that are supported. Representative use of multiple correlated NSIF files includes:

a. Stereo imagery. Some stereo image products are comprised of separate NSIF files for the stereo components of each image scene.

b. Imagery mosaics. Some extremely large image and map products consist of multiple NSIF files structured such that they can be pieced together in mosaic fashion by the interpret application as if the multiple files were a single larger image.

c. Reduced resolution data sets (Rsets). Rset products are comprised of multiple NSIF files. One file contains a full resolution image and the other files contain the same image in a variety of lower resolutions.

d. Imagery and maps. Geo-positioning products exist which consist of multiple separate NSIF files containing interrelated maps, images, graphics, legends, product indices, and geo-reference data.

ANNEX D. STANDARD GEOSPATIAL SUPPORT DATA EXTENSIONS
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ANNEX D. STANDARD GEOSPATIAL SUPPORT DATA EXTENSIONS

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INTRODUCTION

This annex specifies the format and content of a set of controlled tagged record extensions for the NSIF. Detailed descriptions are provided for the overall structure, as well as specification of the valid data content and format, for all fields defined within each specified support data extension (SDE). In addition, technical information is presented to provide a general understanding of the significance of the included fields.

GENERAL REQUIREMENTS

That set of support data needed to accomplish the mission of a system receiving a NSIF file is referred to as "appropriate" support data. The appropriate support data may vary across systems receiving NSIF files. A system receiving a NSIF file may add or subtract support data before passing the file to another system with a different mission. This strategy implies a modular support data definition approach.

Image and raster map providers produce NSIF files with support data from other formats which also contain support information. The extensions described herein define the format for that support information required within a NSIF file containing geo-referenced image, matrix, or raster map data such as that defined in the DIGEST standard. The specified tagged records incorporate all SDEs relevant to geo-referenced image, matrix, or raster map data such as that defined in the Digital Geographic Information Exchange Standard (DIGEST). The information which makes up the SDE is derived from referenced standards including DIGEST. Systems using DIGEST imagery, matrix, or raster map data formatted according to NSIF should be designed to extract the needed data from the tagged records described herein. The categories of image items in a NSIF file, to which the standard support extensions apply, are shown in Table D-1.

Table D-1. Categories of image/matrix/grid data

Categories of Image/Matrix/Grid Data			Data extension to be included in the image subheader		
Definition	ICAT	IREP	ACCURACY	LOCATION	SOURCE
Raster Maps	MAP	MONO, RGB, RGB/LUT	ACCPO or ACCHZ & ACCVT	GEOPS + one of: GEOLO MAPLO GRDPS REGPT	SOURC
Geo-referenced Imagery	VIS, SL, TI , FL, RD, EO, OP, HR, HS, CP, BP, SAR, IR, MS	MONO, RGB, RGB/LUT, MULTI	ACCHZ	GEOPS + one of: GEOLO MAPLO GRDPS REGPT	SNSPS
Matrix Data (elevations)	DTEM	1D, ND	ACCPO or ACCHZ & ACCVT	GEOPS + one of: GEOLO MAPLO GRDPS REGPT	SOURC

Table D-1. Categories of image/matrix/grid data (continued)

Categories of Image/Matrix/Grid Data			Data extension to be included in the image subheader		
Matrix Data (other)	MATR	1D, ND	ACCPO or ACCHZ & ACCVT	GEOPS + one of: GEOLO MAPLO GRDPS REGPT	SOURC
Auxiliary Data • Legend • Color-patch • Location grid	 LEG PAT LOCG	 MONO, RGB, RGB/LUT RGB 2D			

A main image subfile containing image/raster/matrix data may be associated with one or more image subfiles containing auxiliary data : the legend or the color-patch of a map, or a location grid. An associated image subfile contains no SDE; it refers to the main image subfile's SDEs (for example, the coordinates of a location grid are expressed in the absolute reference system defined by the GEOPS SDE of the main image subfile).

The following SDEs are defined for use with geo-referenced image, raster map, matrix, or grid data:

a. For spatial location:

GEOPS	for geo-referencing parameters including datums, ellipsoids, and projections
GRDPS	for non-rectified image, raster, or matrix data that is positioned using a location grid
GEOLO	for image, raster, or matrix data rectified consistently with geographic (lat/long) coordinate systems
MAPLO	for image, raster, or matrix data rectified consistently with cartographic (E,N) coordinate systems
REGPT	for registration points in either geographic or cartographic systems

b. For positional accuracy:

ACCPO	for horizontal and vertical accuracy over regions for which the definitions are constant
ACCHZ	for horizontal accuracy when the vertical accuracy varies across the region for which horizontal accuracy is constant
ACCVT	for vertical accuracy when the horizontal accuracy varies across the region for which vertical accuracy is constant

Positional accuracy description is required when spatial location is defined.

c. For source description:

SNSPS	for sensor parameters
SOURC	for map source information

DETAILED REQUIREMENTS

1. Generic tagged extension mechanism. The tagged record extensions defined in this document are "controlled tagged record extensions" as defined in paragraph 26b of the NSIF standard. The tagged record extension format is summarized here for ease of reference. Table D-2 describes the general format of a controlled tagged record extension. The CETAG, CEVER, and CEL fields essentially form a small (11 byte) tagged record subheader. The format and meaning of the data within the CEDATA field is the subject of this document for several individual controlled tagged record extensions. Multiple tagged extensions can exist within the tagged record extension area. There are several such areas, each of which can contain 99,999 bytes worth of tagged extensions. There is also an overflow mechanism, should the sum of all tags in area exceed 99,999 bytes. The overflow mechanism allows for up to one gigabyte of tags. While the extensions defined in this document will typically be found in the image subheader (IXSHD field), it is possible that they could appear in a Data Extension Segment which is being used as an overflow of the image subheader.

2. Field types. If the information contained within an extension is not available, the extension will not be present in the file. For example, if positional accuracy is homogeneous across the whole data set extension, then the Horizontal and Vertical Accuracy Records will not appear since all of the accuracy will be contained in the Positional Accuracy Record. When an extension is present, all of the information listed as Required (type = R) must be filled in with valid information.

Table D-2. Controlled tagged record extension format
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type Identifier. This field shall contain a valid alphanumeric identifier properly registered with the Custodian.	6	(BCS-A)	R
CEL	Length of CEDATA Field (Number of Bytes) This field shall contain the length, in bytes, of the data contained in CEDATA. The tagged record’s length is 11 + the value of CEL.	5	(BCS-N) 00001 to 99985	R
CEDATA	User-defined Data. This field shall contain data of either binary or character data types defined by and formatted according to user specification. The length of this field shall not cause any other NSIF field length limits to be exceeded but is otherwise fully user defined.	Value of the CEL field	User-defined	R

APPENDIX 1 TO ANNEX D. SPATIAL DATA EXTENSIONS

INTRODUCTION

1. General. This appendix is intended to describe the standard support data extensions (SDEs) used to properly transfer geospatial information to provide accuracy, and coordinate data. The nature of raster data is inherently different than vector data because the pixel representations are rows and columns which means the surface of the earth is being mapped to some type of rectangular grid. Map makers have faced this challenge since the beginning of their profession and many solutions have been put forth to project the spheroidal geometry of the earth to a flat surface such as a paper map. Images of the earth's surface inherit additional complexities due to the look angle of cameras and the other imaging parameters such as focal length, atmosphere refraction, etc.

RELATED DOCUMENTS

STANAG 2215 (Edition 4)	-	Evaluation of Land Maps, 19 Dec. 1983.
STANAG 7074/AGeoP-3A	-	Digital Geographic Information Exchange Standard (DIGEST), Edition 1.2a, June 1995.

GENERAL REQUIREMENTS

2. Approximate geographic location. The IGEOLO and ICOORDS field in the image subheader shall only be used for coarse representation of the geographic or cartographic coordinates of the image.

3. Accurate geographic location. The specified tagged records incorporate all SDEs relevant to geo-referenced image, matrix, or raster map data such as that defined in the Digital Geographic Information Exchange Standard (DIGEST). The information which makes up the SDE is derived from referenced standards including DIGEST. Systems using DIGEST and/or NIMA’s imagery, matrix or raster map data formatted according to NSIF should be designed to extract the needed data from the tagged records described herein.

COORDINATE SYSTEMS

4. General. Most people are familiar with the concept of latitude and longitude for locating places on the face of the earth. Most people have also used graph paper to lay out a garden or house plan where distance left-right and up-down are so many grids cells or simple (x-y) orthogonal measurements in inches or centimetres. These principles for coordinates apply in the geospatial sense but more detail is needed to insure data transfer carries the meaning intended by the transmitter to the receiver.

5. Coordinate system types. Three types of coordinate systems are defined for geospatial information: (1) Geographic (GEO), (2) Cartographic (MAP), and (3) Relative (DIG).

a. GEO. Geographic coordinates are expressed in latitude and longitude and are based on a geodetic datum, including both the geodetic ellipsoid and zero meridian. For the purposes of this standard, the zero meridian will default to GREENWICH (zero degrees longitude). Datums and ellipsoids are carried in the GEOPS extension. DIGEST lists more then 200 different datums. There are so many datums because geodesy continues to refine the understanding of the shape and gravity of the earth. As these refinements mature, maps and other spatial data tend to reflect the best knowledge available at the time the maps and/or data were produced. To properly interpret coordinates one must take into account the mathematics in effect at the time of production. It is often necessary to convert coordinates to a common coordinate system when using data produced in different time frames or by different organisations. Ellipsoids go along with many datums, but DIGEST lists fewer than 60 different ellipsoids. This is because many local datums exist without reference to an ellipsoid but all global coordinate systems use an ellipsoid. Modern mapping prefers the ellipsoid and datum to be consistent with the World Geodetic System 1984 (WGS84).

b. MAP. When using a cartographic coordinate system a location is specified as being so many units North/South (Northing) and so many units East/West (Easting) from a reference point within a defined projection plane. The projection is a mathematical relationship that defines a one-to-one mapping between the geodetic ellipsoid and the projection plane. A cartographic coordinate system is based on a projection (with values for all its associated parameters) applied to a geodetic datum (see above). The projection parameters are described in the GEOPS extension. DIGEST lists approximately 30 different projections and they require from one to six parameters. Note: The cartographic coordinate system may not be described using only PROJECTION field. The geographic coordinate system to which the defined projection applies must always be described.

c. DIG. A relative coordinate system is the natural occurrence when using a digitising tool, a scanner, or raw imagery. These relative coordinate systems must be registered to an absolute coordinate system in order to represent real locations. The absolute coordinate systems may be GEO or MAP as described above. The registration between the relative and absolute coordinate systems will be defined either by the description of registration points (generally three or more) or by the description of location grid(s) (at least one). Normally, the error introduced during digitizing is small compared to the error in the source graphic, but it should not be ignored.

6. Rectified image/raster local coordinate system. Rows and columns of a rectified image/raster data form a regular grid whose axes are parallel to the axes of the absolute coordinate system as defined in the GEOPS extension. When terrain relief is included in the rectification process, the result is called «ortho-rectified». This will be more spatially correct, especially in area that have considerable elevation differences. In this local coordinate system, coordinate sets are composed of a row number and a column number (r,c). The order in which rows and columns are numbered is described in Annex C paragraph 17. The GEOLO and MAPLO extensions provide the appropriate parameters for computing the spatial location of each pixel from its row and column number.

a. MAPLO must be used if the absolute coordinate system is a cartographic coordinate system (E, N). It defines the Easting and Northing of the origin of the grid (LSO,PSO) and the rows and columns width (LAD,LOD) using a defined linear unit (UNILOA).

$$E = LSO + c * LOD * (1_{UNI} / 1_{UNILOA})$$
$$N = PSO - r * LAD * (1_{UNI} / 1_{UNILOA})$$

NOTE: $(1_{UNI} / 1_{UNILOA})$ means the conversion of the unit of LOD (LAD) given by the field UNILOA into the unit of E (S) called UNI in these formulas. If the units are the same, this ratio is equal to 1.

b. GEOLO must be used if the absolute coordinate system is a geographic coordinate system (Long, Lat). It defines the longitude and latitude of the origin of the grid (LSO,PSO), and the number of rows and columns in 360° (BRV,ARV).

$$Long = LSO + c * (360°)_{UNI} / ARV$$
$$Lat = PSO - r * (360°)_{UNI} / BRV$$

NB : $(360°)_{UNI}$ means the value of a 360° angle expressed in the unit of Lat (Long). If the units are degrees, the value is 360.

7. GRID reference image. Non-rectified image or matrix data can be accurately geo-referenced with a grid reference image file. This is the GRDPS extension. Basically, this involves superimposing a grid of spatial location information on top of the image for which the spatial information applies. For example, the grid could have location information (coordinates) at every 10th image pixel (N-S) and (E-W). Then for every image pixel, one could interpolate, using surrounding grid pixels, to estimate the actual geospatial location. This scheme eliminates the need to re-sample the base image to place it in a rectified form. This is important if the base image was a map scanned at a relatively low resolution (e.g., 100 dots per inch) and the re-sampling process would tend to make the resultant raster map too blurred to read. This process also allows a very non-linear stretch within the image space to be geo-referenced with reasonable accuracy for example, aircraft reconnaissance using low scan angles. This results in near field pixels relatively close together and far field pixels far apart. Even with a horizon in the image, one can fill pixel spaces above this horizon with null values to signal that spatial location has no meaning in this empty part of the scene. Another advantage of the grid reference is the simplification of the application software. By using the same grid reference scheme for various types of imagery, the application software can use the same logic and not require a library of algorithms for various projection and sensor parameter solutions.

The extension includes the file identifier (BAD = IID of the grid subfile) of the grid image subfile and precise coordinates of four bounding corners. The Grid Image ID can be found in the Image Subheader, Image ID (IID) field. It also contains the absolute elevation of the grid relative to mean sea level (WGS84) or other specified vertical reference system. The elevation data provides spatial data refinement in areas where terrain relief complicates the geospatial reference problem. For regions of pronounced differences in terrain elevation, it may be necessary to include several sets of grid reference images where the elevation of the grid is adjusted to best match the terrain elevation over that region.

It is important to note that while the grid reference generally gives good accuracy, the quantitative accuracy value at each pixel is difficult to describe.

The grid image subfile is a NSIF subimage containing two bands : Band X giving the longitude or easting coordinates and Band Y giving the latitude or northing coordinates for each grid element. The Band X image file field "ISUBCAT1" may be CGX or GGX and Band Y image file field "ISUBCAT2" may be CGY or GGY. CGX and CGY indicate geographic coordinates (longitude / latitude) and GGX and GGY indicate grid (easting (x) / northing (y)) coordinates.

Let (LSO, PSO) be the origin of the location grid in columns and rows within the image, (LAD, LOD) the interval (measured in image pixels) between 2 consecutive elements of grid (in rows, columns), also being the ratio of image pixels to grid pixels, by row and column.

Let (r,c) be the row and column numbers, of a pixel of interest, within the image. The location of the pixel (r,c) can be interpolated from the four grid points that surround it. Let (LGR, LGC) be the row and column number (in grid numbers) of the upper left corner of the grid square that surrounds the image pixel of interest. These values can be computed as follows:

$$LGR = [\ (r\text{-}PSO) / LAD] \qquad LGC = [\ (c\text{-}LSO) / LOD]$$

where... [x] = integer part of x

Let the four corners of the grid square be numbered 1, 2, 3, 4, as shown on Figure D-1-1. The upper left corner (corner number 1) row and column indexes are $(R_1, C_1) = (LGR, LGC)$. The row and column numbers (R_i, C_i), (i = 2, 3, 4) of the other corners are:

$$(R_2, C_2) = (LGR+1, LGC) \qquad (R_3, C_3) = (LGR, LGC+1) \qquad (R_4, C_4) = (LGR+1, LGC+1).$$

For the example in Figure D-1-1 the solutions are:

$$(R_1, C_1) = (0,1) \qquad (R_2, C_2) = (0,2) \qquad (R_3, C_3) = (1,1) \qquad (R_4, C_4) = (1,2)$$

The image pixel coordinates of the 4 grid corners (r_i, c_i), (i = 1,2,3,4) can be computed as:

$$(r_i, c_i) = (PSO + R_i * LAD, LSO + C_i * LOD).$$

For the example the solutions are:

$$(r_1, c_1) = (3,5) \qquad (r_2, c_2) = (3,8) \qquad (r_3, c_3) = (7,5) \qquad (r_4, c_4) = (7,8)$$

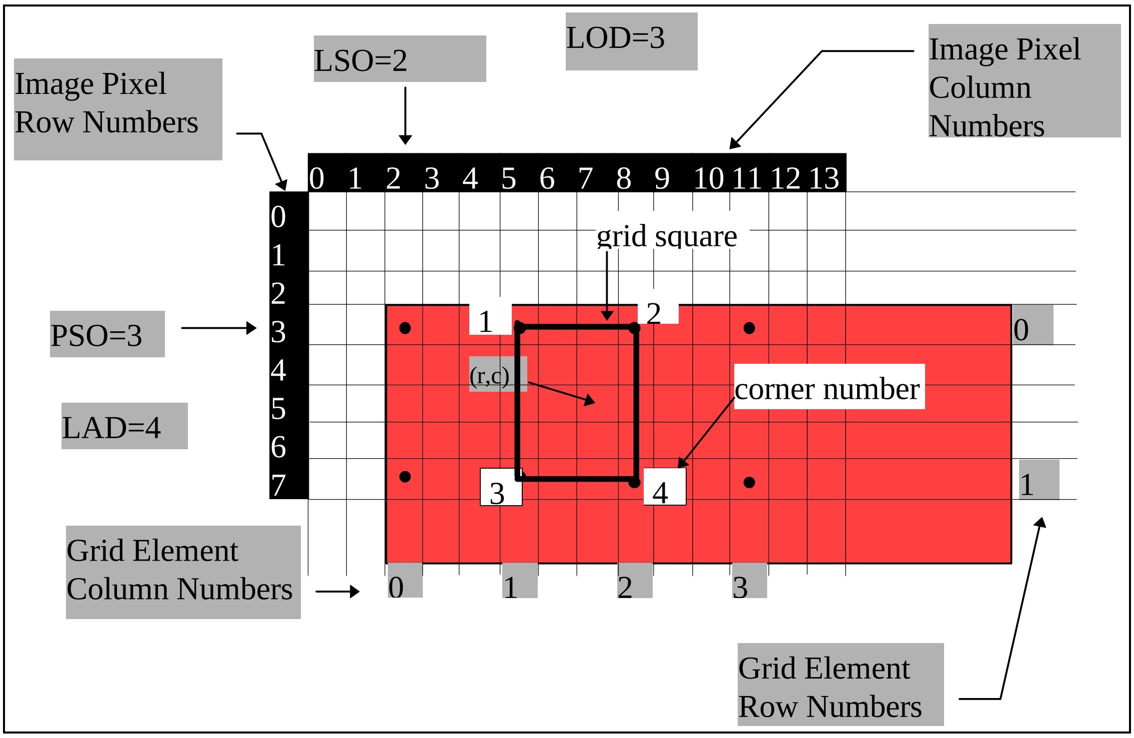

Figure D-1-1. Example of a location grid

In this example, the pixel of interest is (r, c) = (5, 7).

The location information provided by grid data at each of the four corners (X_i, Y_i), (i = 1,2,3,4) is given by:

$$(X_i, Y_i) = (\text{BandX}(R_i, C_i), \text{BandY}(R_i, R_C))\text{.}$$

The interpolation algorithm is a bilinear interpolation between the 4 corners of the grid square. The column and row deltas (a and b), for c and r, are computed as follows:

$$a = (c - c_1) / LOD = (c - (LSO + C_1 * LOD)) / LOD$$
$$b = (r - r_1) / LAD = (r - (PSO + R_1 * LAD)) / LAD$$

and a and b lie between 0 and 1.

The location (X,Y) of the pixel (r,c) is then given by :

$$X = (1- a) * (1- b) * X_1 + a * (1- b) X_2 + (1- a) * b * X_3 + a * b * X_4$$
$$Y = (1- a) * (1- b) * Y_1 + a * (1- b) Y_2 + (1- a) * b * Y_3 + a * b * Y_4$$

For the example, the values of (a and b) are :

$$a = (c - c_1) / LOD = (7 - 5) / 3 = 2/3 \text{ and } b = (r - r_1) / LAD = (5 - 3) / 4 = 1/2$$

giving the interpolation algorithm the following weighted sum:

$$X = X_1/6 + X_2/3 + X_3/6 + X_4/3$$
$$Y = Y_1/6 + Y_2/3 + Y_3/6 + Y_4/3$$

Note that the sum of the weights (1/6 + 1/3 + 1/6 + 1/3) is always equal to 1.

The coding of bands values BandX and BandY will be:

-either integer for cartographic grids, giving easting and northing (in meters) ; in that case, the values of fields of subimage header file or location grid data are :
PVTYPE = INT, NBANDS = 2, IREPBAND1 = LX, ISUBCAT1 = CGX,
IREPBAND2 = LY, ISUBCAT2 = CGY.
-or real (float) for geographic grids, giving longitude and latitude (in decimal seconds) ; in that case, the values of fields of subimage header file or location grid data are:
PVTYPE = R, NBANDS = 2, IREPBAND1 = LX, ISUBCAT1 = GGX,
IREPBAND2 = LY, ISUBCAT2 = GGY.

Grid and elevation (applies to imagery - not applicable to raster maps). A grid is computed at a given elevation, and is valid for that elevation. In most cases, the location given by a grid varies smoothly with this elevation. If the surface covered by the image is flat, its associated grid should be computed at the average ground elevation in this area. Otherwise in case of significant elevation variations over the spot covered by the grid, the image is associated with two grids, one at minimum elevation $\mathbf{z_{min}}$, and the other at maximum elevation $\mathbf{z_{max}}$. A more accurate location of the pixel of interest can be computed by a linear interpolation between the locations computed with the two grids taking account of the estimated elevation from some additional data (such as digital terrain model or maps).

The process is then the following :

-computing the location with the two grids : (X_{min}, Y_{min}) at elevation z_{min}, (X_{max}, Y_{max}) at elevation $\mathbf{z_{max}}$

-from an additional data (e.g. Digital Terrain Model, map ...), estimation of elevation **z** of pixel (whose location can be estimated as $((X_{min}+X_{max})/2, (Y_{min}+Y_{max})/2)$

-compute : $\mu = (z - z_{min}) / (z_{max} - z_{min})$ (notice that $0 \leq \mu \leq 1$)
-compute the final location (X, Y) by linear interpolation:
$(X, Y) = ((1-\mu) X_{min} + \mu X_{max}, (1-\mu) Y_{min} + \mu Y_{max})$

This solution is robust only when the elevation gradient is smooth.

8. Registration points. Each registration point is described by two sets of coordinates: one describes the position of the point using the absolute coordinate system (as described in the GEOPS extension), the other describes the position of the same point in the relative coordinate system (as used in the dataset). The REGPT extension is used to support relative coordinate systems. Note: The position accuracy will be affected by the mathematical function used to transform the coordinates from the relative coordinate system to the absolute one. This process is often referred to a "rubber sheeting" or "warping" an image (or scanned raster file) to best fit an absolute coordinate system. The mathematics will obviously be improved if approximate pixel spacing (in terms of the absolute coordinate system) is known.

9. Geo-reference values for certain standard products. Several standard raster map products exist for which the geo-reference values are understood by default. These default values are summarized in this section:

Arc Standard Raster Products (ASRP)

Type	Geographic (GEO)
Units	Seconds (SEC)
Ellipsoid	WGS84
Datum	WGS84
Projection	ARC (using Zone Number supplied in GEOLO)

UTM/UPS Standard Raster Products (USRP)

Type	Cartographic (MAP)
Units	Meters (M)
Ellipsoid	WGS84
Datum	WGS84

If Zone Number is +60 to+1 (for north of Equator) or -60 to -1 (for south of Equator) the default projection will be:

Projection	Universe Transverse Mercator
Parameter 1	Central Meridian for UTM Zone (Given in MAPLO)
Parameter 2	0.9996
Parameter 3	None
Parameter 4	None
X(Easting) false origin of projection	500000
Y(Northing) false origin of projection	0(N) or 10000000(S)

consistent with Zone Number given in MAPLO Extension

If Zone Number is +61 or -61 the default projection will be:

Projection	Universal Polar Stereographic
Parameter 1	0 or 648000
Parameter 2	0.994
Parameter 3	None
Parameter 4	None
X(Easting) false origin of projection	2000000
Y(Northing) false origin of projection	2000000

POSITIONAL ACCURACY

10. General. Positional accuracy is expressed as a circular error for X,Y-value and as linear error for Z-value according to STANAG 2215.

11. Horizontal and vertical accuracy regions. There must be 100% arial coverage of the geo-referenced image item extent for the total area of the horizontal accuracy regions and 100% arial coverage of the geo-referenced image item extent for the sum of the vertical accuracy regions. Where the information is unknown or not applicable it will be noted with "Not a Number" value. Where the region or sub-region boundaries are coincident with both horizontal and vertical accuracy regions, then the accuracy regions may be combined in the same accuracy support data extension ACCPO. Where the horizontal and vertical boundaries differ in whole or in part, then either totally distinct horizontal and vertical sub-regions may be defined (ACCHZ, ACCVT), or the two approaches may be mixed (e.g. Figure D-1-2).

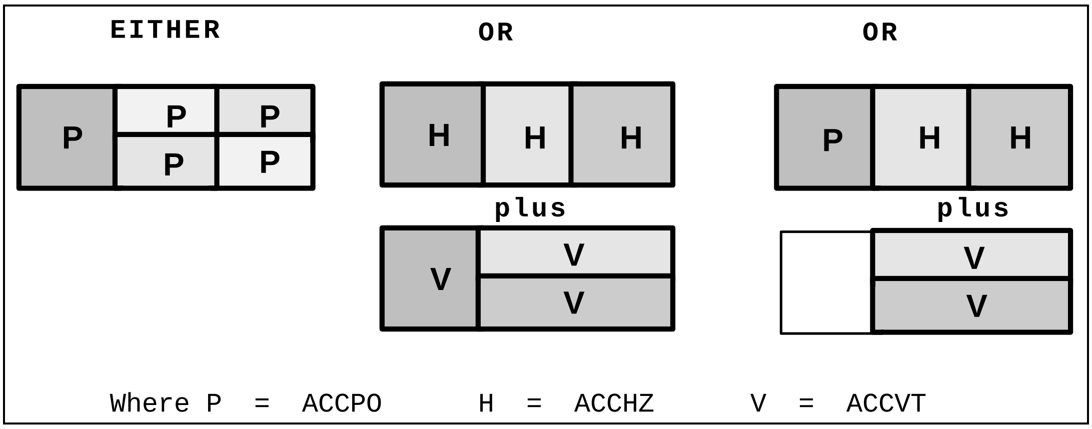

Figure D-1-2. Alternatives for defining mixed positional accuracy areas

DETAILED REQUIREMENTS

12. GEOPS - geo positioning information. GEOPS defines the absolute coordinate system to which the data is geo-referenced. This absolute coordinate system may be a geographic system or a cartographic coordinate system. The GEOPS extension is detailed in Table D-1-1. A single GEOPS must be placed in the Image Subheader Extended Subheader Data field for each geo-referenced image item in a NSIF file.

Table D-1-1. GEOPS - geo positioning information extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A GEOPS	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 151+NUM_PRJ*15+30	R
The following fields define GEOPS...				
TYP	Type of Coordinate System. Type of Coordinate system for the image data: GEO: longitude, latitude; MAP: Easting, Northing; DIG longitude, latitude or Easting, Northing registered through a location grid or registration points	3	BCS-A MAP, GEO, or DIG	R
UNI	Units of Measure for Coordinates. Units of measure for this data set.	3	BCS-A See Table D-7-1	R
ELL	Ellipsoid Name. Name of the ellipsoid to which the Data set refers. (See DIGEST 1.2 Part 3 - 10)	25	BCS-A See Table D-7-1	R
ELC	Ellipsoid Code. Code of the ellipsoid to which the Data set refers.	3	BCS-A See Table D-7-1	R
DVR	Vertical Datum Name.	25	BCS-A See Table D-6-3	R
VDCDVR	Vertical Datum Code.	4	BCS-A See Table D-6-3	R
DAG	Datum Geodetic Name.	25	BCS-A See Table D-6-2	R
DCD	Datum Geodetic Code.	4	BCS-A See Table D-6-2	R
GRD	Cartographic Grid Code. Code of the grid system. Defaulted to blank spaces.	3	BCS-A (See Table D-6-6)	<R>
GRN	Grid Description. Text description of the grid system. Defaulted to blank spaces	25	BCS-A	<R>
ZNA	Grid Zone number. Necessary when the grid system comprise more than one zone. Defaulted to 000 otherwise.	3	BCS-N	R
PRN	Projection Name.	25	BCS-A See Table D-6-5	R
PCO	Projection Code.	2	BCS-A See Table D-6-5	R
NUM_PRJ	Number of Projection Parameters	1	BCS-N 0-9	R

Table D-1-1. GEOPS - geo positioning information extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
For each projection parameter...				
PRJ	Projection Parameter (See Table D-6-5)	15	BDS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	C
...				
NOTE: The following fields are not included in the repetition of fields designated by NUM_PRJ.				
XOR	Projection False X (Easting) Origin.	15	BCS-N See Table D-6-5	R
YOR	Projection False Y (Northing)Origin.	15	BCS-N See Table D-6-5	R

13. GRDPS -grid reference data. When the image, matrix,or raster data is not rectified, the geographic location of each pixel may be derived from a given set of location grids computed for a given elevation. The user defined fields of the GRDPS extension are detailed in Table D-1-2. A single GRDPS is placed in the Image Subheader, following GEOPS. The coordinates expressed in the location grids refer to the absolute coordinate system defined in GEOPS.

Table D-1-2. GRDPS - grid reference data extensions
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A GRDPS	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field)	5	BCS-N 2 + NUM_GRDS * 68	R
The following fields define GRDPS...				
NUM_GRDS	Number of Location Grids	2	BCS-N 01-20	R
For each location grid...				
ZVL	Elevation of the Grid (Meters).	10	BCS-N ±zzzzzzzz.	R
BAD	Identifier of the Grid Image IDFile.	10	BCS-A	R
LOD	Data Interval in image pixels. (column wise), also being ratio of image pixels to grid elements	5	BCS-N 00001-99999	R
LAD	Data Interval in image pixels. (row wise), also being ratio of image pixels to grid elements	5	BCS-N 00001-99999	R
LSO	Column Number of the Origin of Location Grid.	11	BCS-N	R
PSO	Row Number of the Origin of Location Grid.	11	BCS-N	R
NCOLS	Number of Columns in the Location Grid.	8	BCS-N 00000001-999999999	R
NROWS	Number of Rows in the Location Grid.	8	BCS-N 00000001-999999999	R

14. GEOLO - local geographic (lat/long) coordinate system. For rectified data (rows and columns are aligned with the coordinate system axis) GEOLO provides the description of the link between the local coordinate system (rows and columns) and the absolute geographic coordinate system (longitude and latitude) defined by GEOPS. The user defined fields of the GEOLO extension are detailed in Table D-1-3. A single GEOLO is placed in the Image Subheader, following GEOPS.

Table D-1-3. GEOLO - local geographic coordinate system extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A GEOLO	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 00048	R
The following fields define GEOLO...				
ARV	Number of Elements in 360 Degrees (E-W). Pixel ground spacing...number of pixels in 360 degrees (E-W)	9	BCS-N 000000002 - 999999999	R
BRV	Number of Elements in 360 Degrees (N-S). Pixel ground spacing...number of pixels in 360 degrees (N-S)	9	BCS-N 000000002 - 999999999	R
LSO	Longitude of Reference Origin.	15	BCS-N ±ddd.dddddddddd	R
PSO	Latitude of Reference Origin.	15	BCS-N ±0dd.dddddddddd	R

15. MAPLO - local cartographic (x, y) coordinate system. For rectified data (rows and columns are aligned with the coordinate system axis) MAPLO provides the description of the link between the local coordinate system (rows and columns) and the absolute cartographic coordinate system (Easting and Northing) defined by GEOPS. The user defined fields of the MAPLO extension are detailed in Table D-1-4. A single MAPLO is placed in the Image Subheader, following GEOPS.

Table D-1-4. MAPLO - local cartographic coordinate system extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A MAPLO	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 00043	R
The following fields define MAPLO...				
LOD	Data Density for E/W Direction. Data interval in E-W direction	5	BCS-N 00001-99999	R
LAD	Data Density for N/S Direction. Data interval in N-S direction	5	00001-99999	R
UNILOA	Units of Measurement of LOD and LAD.	3	BCS-A See Table D-7-1	R
LSO	Easting of Reference Origin.	15	BCS-N ±mmmmmmmmmmmm.m	R
PSO	Northing of Reference Origin.	15	BCS-N ±mmmmmmmmmmmm.m	R

16. REGPT - registration points. Registration points may be provided for image or map data to identify specific pixels in this data and provide spatial locations (geographic or cartographic) for these pixels. With this information the entire image or map pixel set can be adjusted to improve overall accuracy. The extension is called REGPT and Table D-1-5 details the user defined fields. The coordinates of the registration points refer to the absolute coordinate system defined in GEOPS.

Table D-1-5. REGPT - registration point extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A REGPT	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to follow (e.g., length of data in tag data field).	5	(BCS_N) 2 + NUM_PTS * 83	R
The following fields define REGPT...				
NUM_PTS	Number of Registration Points to Follow	2	BCS-N 01 - 99	R
For each registration point...				
PID	Point Identification.	5	BCS-A	R
LON	Longitude/Easting of Registration Point	15	BCS-N ±ddd.dddddd / ±mmmmmmmmmmmm.m	R
LAT	Latitude/Northing of Registration Point	15	BCS-N ±0dd.dddddd / ±mmmmmmmmmmmm.m	R
ZVL	Elevation of Registration Point	15	BCS-N ±mmmmmmmmmmmm.m	R
DIX	Column Number of Registration Point	11	BCS-N 00000000001- 99999999999	R
DIY	Row Number of Registration Point	11	BCS-N 00000000001- 99999999999	R
DIZ	Local Z Coordinate of Registration Point	11	BCS-N ±mmmmmmmm.m	R

17. ACCPO - positional accuracy. The user defined fields of the ACCPO extension are detailed in Table D-1-6. If horizontal (ACCHZ) and vertical (ACCVT) extensions are used then ACCPO will not be used.

Table D-1-6. ACCPO - positional accuracy extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A ACCPO	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 2 + NUM_ACPO * (34 + NUM_COO*30)	R

Table D-1-6. ACCPO - positionalaccuracy extension

FIELD	NAME	SIZE	VALUE RANGE	TYPE
The following fields define ACCPO..				
NUM_ACPO	Number of ACCPORecord Sets to Follow. This field defines the number of accuracy sets to follow. The number will be"01" if the entire data set only has one set of accuracy. If vertical and horizontal accuracy are not homogeneous within definable regions then there may be different numbers of sets between horizontal and vertical. The maximum number of regions is limited to 20.	2	BCS-N 01 - 20	R
For each ACCPO record.. (defined by the following fields of ACCPO extension)				
AAH	Absolute Horizontal Accuracy. Absolute horizontal accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAAH	Unit of Measure for AAH. Units for AAH (SeeTable D-7-1)	3	BCS-A	R
AAV	Absolute Vertical Accuracy. Absolute vertical accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAAV	Unit of Measure for AAV. Units for AAV (SeeTable D-7-1)	3	BCS-A	R
APH	Point-to-Point (Relative) Horizontal. Point-to-point (relative) horizontal accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAPH	Unit of Measure for APH. Units for APH (SeeTable D-7-1)	3	BCS-A	R
APV	Point-to-Point (Relative) Vertical. Point-to-point (relative) vertical accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAPV	Unit of Measure for APV. Units for APV (SeeTable D-7-1)	3	BCS-A	R
NUM_COO	Number of Coordinates in Bounding Polygon. This field defined the number of coordinate pairs that are used to define a sub-region. If the accuracy information applies to the entire data set, then this field does not apply and will be zero filled.	2	BCS-N 00-20	R
For each coordinate pair...(the following 2 fields onlyappear when NUM_COO is not 00)				
LON	Longitude(DEG)/Easting (M). Longitude or Easting coordinate value (Longitude in decimal degrees and Easting in meters)	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	C
LAT	Latitude (DEG)/Northing(M). Latitude or Northing coordinate value (Latitude in decimal degrees and Northing in meters).	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmmm.m	C
. . .				

Note 1: Accuracy values are computed as 90% probable (ref. STANAG 2215 (Edition 4)).

Note 2: The coordinate system (Latitude/Longitude or Northing/Easting) is defined in the GEOPS extension.

18. ACCHZ - horizontal accuracy. The user defined fields of the ACCHZ extension are detailed in Table D-1-7.

Table D-1-7. ACCHZ - horizontal extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A ACCHZ	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 2 + NUM_ACHZ * (18 + NUM_COO*30)	R
The following fields define ACCHZ..				
NUM_ACHZ	Number of ACCHZ Record Sets to Follow. This field defines the number of accuracy sets to follow. The number will be "01" if the entire data set only has one set of accuracy. If vertical and horizontal accuracy are not homogeneous within definable regions then there may be different numbers of sets between horizontal and vertical. The maximum number of regions is limited to 20.	2	BCS-N 01 - 20	R
For each ACCHZ record.. (defined by the following fields of ACCHZ extension)				
AAH	Absolute Horizontal Accuracy. Absolute horizontal accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAAH	Unit of Measure for AAH. Units for AAH (See Table D-7-1)	3	BCS-A	R
APH	Point-to-point (Relative) Horizontal. Point-to-point (relative) horizontal accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAPH	Unit of Measure for APH. Units for APH (See Table D-7-1)	3	BCS-A	R
NUM_COO	Number of Coordinates in Bounding Polygon. This field defined the number of coordinate pairs that are used to define a sub-region. If the accuracy information applies to the entire data set, then this field does not apply and will be zero filled.	2	BCS-N 00-20	R
For each coordinate pair...(the following 2 fields only appear when NUM_COO is not 00)				
LON	Longitude(DEG)/Easting (M). Longitude or Easting coordinate value (Longitude in decimal degrees and Easting in meters).	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	C
LAT	Latitude (DEG)/Northing(M). Latitude or Northing coordinate value (Latitude in decimal degrees and Northing in meters).	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	C
. . .				

Note 1: Accuracy values are computed as 90% probable (ref. STANAG 2215 (Edition 4)).

Note 2: The coordinate system (Latitude/Longitude or Northing/Easting) is defined in the GEOPS extension.

19. ACCVT - vertical accuracy. The user defined fields of the ACCVT extension are detailed in Table D-1-8.

Table D-1-8. ACCVT - vertical accuracy extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A ACCVT	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 2 + NUM_ACVT * (18 + NUM_COO*30)	R
The following fields define ACCVT..				
NUM_ACVT	Number of ACCVT Record Sets to Follow. This field defines the number of accuracy sets to follow. The number will be "01" if the entire data set only has one set of accuracy. If vertical and horizontal accuracy are not homogeneous within definable regions then there may be different numbers of sets between horizontal and vertical. The maximum number of regions is limited to 20	2	BCS-N 01 - 20	R
For each ACCVT record.. (defined by the following fields of ACCVT extension)				
AAV	Absolute Vertical Accuracy. Absolute vertical accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAAV	Unit of Measure for AAV. Units for AAV (See Table D-7-1)	3	BCS-A	R
APV	Point-to-Point (Relative) Vertical. Point-to-point (relative) vertical accuracy for the defined region/sub-region	5	BCS-N 00000-99999	R
UNIAPV	Unit of Measure for APV. Units for APV (See Table D-7-1)	3	BCS-A	R
NUM_COO	Number of Coordinates in Bounding Polygon. This field defined the number of coordinate pairs that are used to define a sub-region. If the accuracy information applies to the entire data set, then this field does not apply and will be zero filled.	2	BCS-N 00-20	R
For each coordinate pair...(the following 2 fields only appear when NUM_COO is not 00)				
LON	Longitude (DEG)/Easting (M). Longitude or Easting coordinate value (Longitude in decimal degrees and Easting in meters)	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	C
LAT	Latitude (DEG)/Northing (M). Latitude or Northing coordinate value (Latitude in decimal degrees and Northing in meters).	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	C
. . .				

Note 1 : Accuracy values are computed as 90% probable (ref. STANAG 2215 (Edition 4)).

Note 2 : The coordinate system (Latitude/Longitude or Northing/Easting) is defined in the GEOPS extension.

APPENDIX 2 TO ANNEX D. MAP SOURCE DATA EXTENSION

INTRODUCTION

The map source data extension (SOURC) provides extensive information about the source graphics (one or more). Since these sources are maps or charts, a cartographic (MAP) coordinate system applies and must include ellipsoid, datum, and projection data. In addition, if elevation or depth information is present on the source map, the vertical or sounding datum must be supplied.

GENERAL REQUIREMENTS

The source graphic may include several map insets and usually includes legend data that is important to capture as raster files. Insets have a specific coordinate system defined which may be different for each one and different than the one used for the main source graphic. The mechanism is the same as for relative coordinate systems with the four corners of the inset interpreted as registration points. Relative coordinates give the location of the outside of the corners (as computed from the row and column number of each corner). Absolute coordinates will give the location of the inside of the corners. Both locations will be described in the same coordinate system as defined in the GEOPS extension. The only transformation allowed is change of scale and offset.

In northern latitudes, certain maps may include a grid overlay for convenience of navigation where longitude arcs are rapidly converging. The overlays normally include Grid North-Magnetic North Angle (GMA) and a Grid Convergence Angle (GCA). Note: When the primary grid displayed on the map is not strictly registered to the map projection, it is best to use the projection to which the primary grid is registered to the map projection. This allows the application to use the parameters of the source file for transforming the coordinates from the coordinate system of the dataset to the coordinate system displayed on the grid.

DETAILED REQUREMENTS

1. SOURC - map source description. The user defined fields of the SOURC extension are detailed in Table D-2-1, and the descriptions of these fields are detailed in Table D-2-2

Table D-2-1. SOURC - source extension
TYPE “R” = Required, “<R>” = Null Allowed, “C” = Conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A SOURC	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 2 + NUM_SOUR * (312 + NUM_MAG * 74+ 2 + NUM_COO *30 + 28 + NUM_PRJ*15 +90+ NIN *284 + NLI *27)	R
The following fields define SOURC..				
NUM_SOUR	Number of Source Description	2	BCS-N	R
For each source...				
BAD	Identifier of Derived Image layer (Image ID)	10	BCS-A	R
NLI	Number of Legend Images	2	BCS-N	R
NIN	Number of Insets	2	BCS-N	R
PRT	Series Designator	10	BCS-A (e.g. 1501G)	R

Table D-2-1. SOURC - source extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
URF	Unique Source ID. (Number or name which, when used with series and edition, will uniquely identify the source)	20	BCS-A	R
EDN	Source Edition Number	7	BCS-A	R
NAM	Full Name of Source Document	20	BCS-A	R
CDP	Type of Significant Date (that most accurately describes basic date of the product for computation of the probable obsolescence date. It can be compilation date, revision date, or other depending on the product and circumstances.)	3	BCS-N (See Table D-5-1)	R
CDV	Significant Date Value	8	BCS-A (YYYYMMDD)	R
CDV27	Perishable Information Date Value	8	BCS-A (YYYYMMDD)	R
SCA	Reciprocal Cartographic Scale	9	BCS-N	R
GRD	Cartographic Grid Code. Code of the grid system. Defaulted to blank spaces.	3	BCS-A (See Table D-6-6)	R
GRN	Grid Description Text. Description of the grid system. Defaulted to blank spaces	25	BCS-A	R
ZNA	Grid Zone number. Necessary when the grid system comprise more than one zone. Defaulted to 000 otherwise.	3	BCS-N	R
SQU	Area Coverage (Number of square units in coverage)	10	BCS-N	R
UNISQU	Unit of Measure for SQU	3	BCS-A (See Table D-7-1)	R
PCI	Predominant Contour Interval	4	BCS-N	R
UNIPCI	Unit of Measure for Contour Interval	3	BCS-A (See Table D-7-1)	R
WPC	Percentage Covered by Water	3	BCS-N	R
NST	Navigation System Type	3	BCS-N (See Table D-5-2)	R
ELL	Ellipsoid Name to which the source refers	25	BCS-A (See Table D-6-1)	R
ELC	Ellipsoid Code	3	BCS-A (See Table D-6-1)	R
DVR	Datum Vertical Reference	25	BCS-A (See Table D-6-3)	R
VDCDVR	Code for Datum of Vertical Reference	4	BCS-A (See Table D-6-3)	R
SDA	Sounding Datum Name	25	BCS-A (See Table D-6-4)	R
VDCSDA	Code for Sounding Datum	4	BCS-A (See Table D-6-4)	R
DAG	Geodetic Datum Name	25	BCS-A (See Table D-6-2)	R
DCD	Geodetic Datum Code	4	BCS-A (See Table D-6-2)	R
HKE	Highest Known Elevation in Source	6	BCS-N (e.g. ±NNNNN)	R
UNIHKE	Units of HKE	3	BCS-A (See Table D-7-1)	R

Table D-2-1. SOURC - source extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
LONHKE	Longitude/Easting of HKE	15	BCS-N ±ddd.ddddddddd / ±mmmmmmmmmmmm.m	R
LATHKE	Latitude/Northing of HKE	15	BCS-N ±0dd.ddddddddd / ±mmmmmmmmmmmm.m	R
NUM_MAG	Number of Sets of Magnetic Information	2	BCS-N 00-20	R
For each set of magnetic information.. (the following fields onlyappear when NUM_MAG is not 00)				
CDP	Type of Date	3	BCS-N (See Table D-5-1)	R
CDV	Date of Magnetic Information	8	BCS-A (YYYMMDD)	R
RAT	Annual Angular Magnetic Rate of Change (actual real value)	8	BCS-N	R
UNIRAT	Units for Magnetic Rate of Change	3	BCS-A (See Table D-7-1)	R
GMA	Grid North - Magnetic North Angle(GMA)	8	BCS-N	R
UNIGMA	Units of GMA	3	BCS-A (See Table D-7-1)	R
LONGMA	Longitude/Easting Coordinate of GMA Reference Point	15	BCS-N ±ddd.ddddddddd / ±mmmmmmmmmmmm.m	R
LATGMA	Latitude/Northing Coordinate of GMA Reference Point	15	BCS-N ±0dd.ddddddddd / ±mmmmmmmmmmmm.m	R
GCA	Grid Convergence Angle (actual real value)	8	BCS-N	R
UNIGCA	Units of GCA	3	BCS-A (See Table D-7-1)	R
NOTE: The following fields are not included in the repetition of fields designated by NUM_MAG				
NUM_COO	Number of Coordinates in Bounding Polygon	2	BCS-N (04 - 99)	R
For each coordinate...				
LON	Longitude/Easting of Point	15	BCS-N ±ddd.ddddddddd / ±mmmmmmmmmmmm.m	R
LAT	Latitude/Northing of Point	15	BCS-N ±0dd.ddddddddd / ±mmmmmmmmmmmm.m	R
. . . .				
NOTE: The following fields are not included in the repetition of fields designated by NUM_COO.				
PRN	Projection Name	25	BCS-A (See Table D-6-5)	R
PCO	Projection Code	2	BCS-A (See Table D-6-5)	R
NUM_PRJ	Number of Projection Parameters	1	BCS-N 0-9	R

Table D-2-1. SOURC - source extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
For each projection parameter...				
PRJ	Projection Parameter. See Table D-6-5	15	BDS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	C
...				
NOTE: The following fields are not included in the repetition of fields designated by NUM_PRJ.				
XOR	X (Easting) False Origin of Projection	15	BCS-N ±mmmmmmmmmmmmm.	R
YOR	Y (Northing) False Origin of Projection	15	BCS-N ±mmmmmmmmmmmmm.	R
QSS	Security Classification of Source	1	T | S | C | R | U	R
QOD	Originator's Permission Required for Downgrading (Y or N)	1	Y | N	R
CDV10	Downgrading Date Value	8	YYYYMMDD (Blank if QOD is "Y")	R
QLE	Releasibility (If no release restrictions exits, "UNRESTRICTED" shall be entered)	25	BCS-A	R
CPY	Copyright Statement (If none, "UNCOPYRIGHTED" shall be entered)	25	BCS-A	R
For each inset... (the following fields onlyappear when NIN is not 00)				
INT	Unique ID for Inset	10	BCS-A	R
SCA	Reciprocal Scale of inset	9	BCS-N	R
NAM	Name of Inset	25	BCS-A	R
NTL	Absolute longitude of lower left corner of inset	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	R
TTL	Absolute latitude of lower left corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmmm.m	R
NVL	Absolute longitude of upper left corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	R
TVL	Absolute latitude of upper left corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmmm.m	R
NTR	Absolute longitude of upper right corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	R
TTR	Absolute latitude of upper right corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmmm.m	R
NVR	Absolute longitude of lower right corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	R
TVR	Absolute latitude of lower right corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmmm.m	R
NRL	Relative longitude of lower left corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmmm.m	R

Table D-2-1. SOURC - source extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
TRL	Relative latitude of lower left corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	R
NSL	Relative longitude of upper left corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	R
TSL	Relative latitude of upper left corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	R
NRR	Relative longitude of upper right corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	R
TRR	Relative latitude of upper right corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	R
NSR	Relative longitude of lower right corner	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	R
TSR	Relative latitude of lower right corner	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	R
For each legend... (the following fields onlyappear when NLI is not 00)				
NAM	Legend name	25	BCS-A	R
BAD	Image file Identifier (Image ID)	2	BCS-N 00 - 99	R
. . .				
NOTE: All the preceding groups of fields are included in the repetition of fields designated by NUM_SOUR.				

APPENDIX 3 TO ANNEX D. SENSOR PARAMETERS DATA EXTENSION

INTRODUCTION

This appendix is intended to describe the sensor parameters data extension (SNSPS), containing the image auxiliary data (relevant to the capture of images by a sensor and its associated platform (aircraft, satellite...). These parameters allow a location model of the sensor(s) to accurately compute the location of any pixel of the image. An image may be composed of many parts, each of them defined by a set of sensor parameters.

GENERAL REQUIREMENTS

The following specifies the parameters defining the attributes of the image, sensor and platform, that are most currently used. These basic parameters are:

- identification of sensor and platform,
- date and time of capture,
- identification of bands of image at capture stage,
- resolution and pixel spacing (space sampling) at capture stage,
- processing level of image (if any),
- attitude of sensor.

In addition, a way to include specific parameters for a specific sensor/platform (called additional auxiliary information) is proposed by giving the related information, for each specific parameter : identification, format, unit and value. For some sensors, there may be a large number of specific parameters; in that case, a better solution may be a dedicated sensor data extension.

DETAILED REQUREMENTS

1. SNSPS - Sensor parameters data extension. The user defined fields of the SNSPS data extension are detailed in Table D-3-1, together with their descriptions. The attitude data are given relative to the orbital reference of the sensor. The additional auxiliary parameters can be either character strings, integer, or floating point numeric values. The auxiliary parameter value format discriminates between the 3 possible cases. The precision (and units) of the numeric values define the accuracy required by the location model.

Table D-3-1. SNSPS - sensor parameters data extension
TYPE "R" = Required, "<R>" = Null Allowed, "C" = Conditional
("†" annotations are explained at the end of the table)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier.	5	BCS-A SNSPS	R
CEVER	Version.	1	BCS-A A	R
CEL	Length of Data to Follow (e.g., length of data in tag data field).	5	BCS-N 2 + NUM_SNS∗ (2 + NUM_BAND∗ 15+ 257 + NUM_AUX∗ (34 (if APF = I) otherwise 44) + 12 + NUM_COO∗30)	R
The following fields define SNSPS				
NUM_SNS	Number of sets of sensor parameters	2	BCS-N	R
For each set of sensor parameters (for each image part)... (the following groups of fields appear)				
NUM_BAND	Number of Bands of sensor image at capture	2	BCS-N	R

Table D-3-1. SNSPS - sensor parameters data extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
For each band ...(the following 3 fields onlyappear when NUM_BAND is not 00)				
BID	Original Scene Band Identification (original sensor image product)	5	BCS-A	R
WS1	Signal Lower Limit (in Nanometres for Wavelength)	5	BCS-N	R
WS2	Signal Upper Limit (in Nanometers for Wavelength)	5	BCS-N	R
. . .				
NOTE: The following fields are not included in the repetition of fields designated by NUM_BAND.				
REX	Resolution E-W Direction	6	BCS-N	R
REY	Resolution N-S Direction	6	BCS-N	R
GSX†[1]	Ground Sample Distance E-W Direction Ground pixel spacing (sampling) at capture stage measured at pixel GSL.	6	BCS-N	R
GSY	Ground Sample Distance N-S Direction. Ground pixel spacing (sampling) at capture stage measured at pixel GSL.	6	BCS-N	R
GSL	Location of pixel for GSX and GSY	12	BCS-A (e.g. UPPER LEFT, LOWER LEFT, UPPER RIGHT, LOWER RIGHT, CENTER)	R
UNIRES	Unit for resolution and ground sample distance	3	BCS-A (See Table D-7-1)	R
Basic_Auxilliary_Parameters				
PLTFM	Platform Name ex. : SPOT3	8	BCS-A	R
INS	Sensor or Instrument Name ex. : HRV1	8	BCS-A	R
MOD	Spectral Mode ex. : PAN	4	BCS-A	R
PRL	Processing Level ex. : 1A	5	BCS-A	R
CDV07	Acquisition Date	8	BCS-A (YYYYMMDD)	R
ACT	Acquisition Time (seconds)	14	BCS-A	R
ANG	Incidence Angle at Original Scene Centre	7	BCS-N	R
UNIANG	Unit of Incidence Angle	3	BCS-A (See Table D-7-1)	R
ALT	Altitude of Sensor	9	BCS-N +/-AAAA.AAA	R
UNIALT	Unit of Altitude	3	BCS-A (See Table D-7-1)	R
LONSCC	WGS84 Longitude of Original Scene Centre	10	BCS-N +/-SSSSSS.SS	R
LATSCC	WGS84 Latitude of Original Scene Centre	10	BCS-N +/-SSSSSS.SS	R
SAZ	Solar Azimuth at Original Scene Centre	7	BCS-N +/-DDD.DD	R
SEL	Solar Elevation at Original Scene Centre	7	BCS-N +/-DDD.DD	R

Table D-3-1. SNSPS - sensor parameters extension (continued)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
UNISAE	Unit of Solar Angles (Decimal degrees)	3	BCS-A (See Table D-7-1)	R
ROL	Roll of the Sensor at Original Scene Centre	7	BCS-N +/-DDD.DD	R
PIT	Pitch of the Sensor at Original Scene Centre	7	BCS-N +/-DDD.DD	R
YAW	Yaw of the Sensor at Original Scene Centre	7	BCS-N +/-DDD.DD	R
UNIRPY	Unit of Attitude Angles	3	BCS-A (See Table D-7-1)	R
PXT	Pixel Time (start time of acquisition)	14	BCS-N	R
UNIPXT	Unit of Pixel Time (S)	3	BCS-A (See Table D-7-1)	R
ROS	Roll Speed at Original Scene Centre	22	BCS-N	R
PIS	Pitch Speed at Original Scene Centre	22	BCS-N	R
YAS	Yaw Speed at Original Scene Centre	22	BCS-N	R
UNISPE	Unit of Attitude Speed	3	BCS-A (See Table D-7-1)	R
NUM_AUX	Number of Auxiliary Parameters	2	BCS-N	R
For each additional auxiliary parameter ††[1]... (the following fields only appear when NUM_AUX is not 00)				
API	Auxiliary Parameter ID	20		R
APF	Auxiliary Parameter Value Format	1	BCS-A {I | R | A}	R
UNIAPX	Unit of Auxiliary Parameter	3	BCS-A (See Table D-7-1)	R
APN	Auxiliary Parameter Integer Value This field appears if and only if APF value is I	10	BCS-N	C
APR	Auxiliary Parameter Real Value This field appears if and only if APF value is R	20	BCS-N	C
APA	Auxiliary Parameter Characters String Value This field appears if and only if APF value is A	20	BCS-A	C
. . .				
NOTE: The following fields are not included in the repetition of fields designated by NUM_AUX.				
BAD	Identifier of Derived Image layer (Image ID)	10	BCS-A	R
NUM_COO	Number of Coordinates in Bounding Polygon	2	BCS-N (04 - 99)	R
For each coordinate...				
LON	Longitude/Easting of Point	15	BCS-N ±ddd.dddddddddd / ±mmmmmmmmmmmm.m	R
LAT	Latitude/Northing of Point	15	BCS-N ±0dd.dddddddddd / ±mmmmmmmmmmmm.m	R
. . .				
NOTE: All the preceding groups of fields are included in the repetition of fields designated by NUM_SNS.				

†[1] GSX can be equal to REX (e.g. for SPOT images in PAN mode, REX = GSX = 10 m) or different (e.g. for ERS1 SAR PRI images, REX = 27 m, GSX = 12.5 m)

††[1] The definition of an additional parameter is necessarily given by the fields API, APF, UNIAPX and by one of the fields APN, APR and APA, depending of the format (APF) of the parameter value.

APPENDIX 4 TO ANNEX D : SAMPLE NSIF FILE STRUCTURE WITH LOCATION GRIDS

The example given here is that of NSIF file for the exchange of a non rectified image, with 2 associated geographic grids, one at minimum elevation on the image area (GRID1, with ZVL = 100 m), the other at maximum elevation on the image area (GRID2, with ZVL = 200 m).

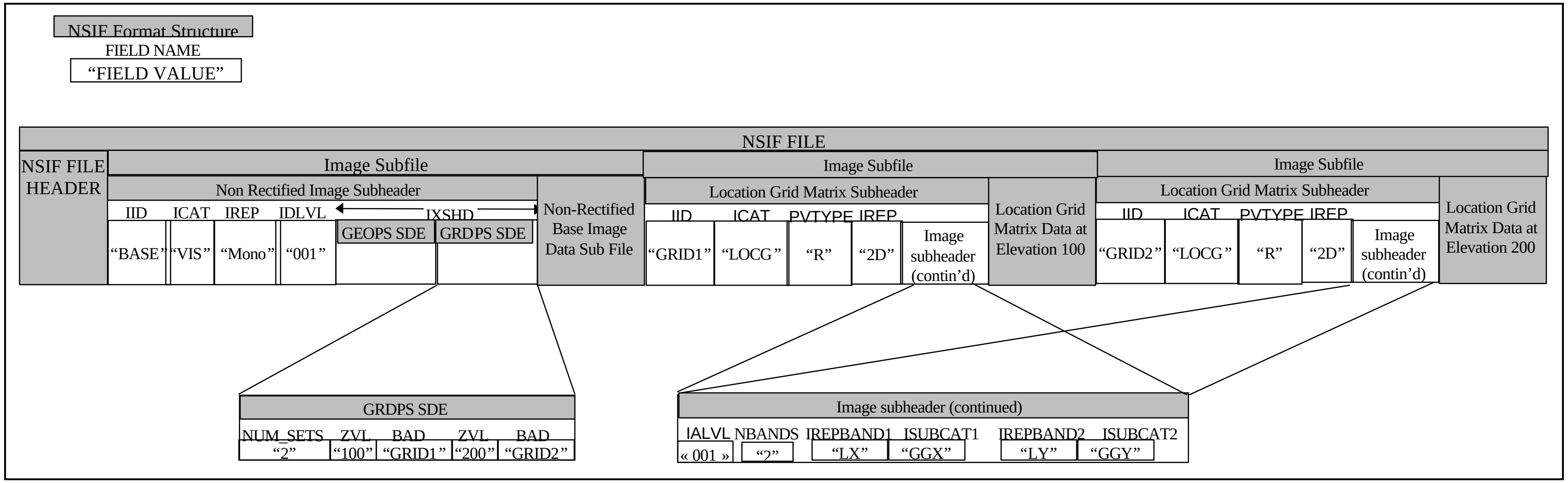

Figure D-4-1. Sample NSIF file structure with location grids

The coding of bands values BandX and BandY of location grid matrix data will be sequential or interleaved depending on IMODE value.

APPENDIX 5 TO ANNEX D. DIGEST DATE AND NAVIGATIONAL SYSTEM TYPE

DIGEST CALENDAR DATE TYPE

1. Calendar date type. CDP values give the type of report or activity ; the specified values are (From DIGEST Part 4 - Annex B: FACC Codes):

Table D-5-1. DIGEST calendar date type

VALUE	DEFINITION
0	Unknown
1	Aerial photography
2	Air information
3	Approximate
4	Field classification
5	Compilation
6	Copyright
7	Creation
8	Digitizing
9	Distribution/Dispatching
10	Downgrading
11	Drafting/Scribing/Drawing
12	Edition
13	Field examination
14	Intelligence
15	Date interpretable
16	Processing
17	Print/Publication
18	Receipt
19	Source
20	Earliest date of source
21	Latest date of source
22	Specifications
23	Survey
24	Up-to-dateness/revision
25	Map Edit
26	Information as of ---
27	Perishable information date
28	Cycle date
29	Significant date
30	Date of magnetic information
999	Other

DIGEST NAVIGATIONAL SYSTEM TYPE

2. Navigational system type. NST values give the type of equipment or system used in electronic navigation (primary system) ; the specified values are (From DIGEST Part 4 - Annex B : FACC Codes):

Table D-5-2. DIGEST navigational system type

VALUE	DEFINITION
0	Unknown
1	Circular Radio Beacon
2	CONSOL
3	DECCA
4	Radio direction finding
5	Directional Radio Beacon

Table D-5-2. DIGEST navigational system type (continued)

VALUE	DEFINITION
6	Distance finding
7	Long Range Air Navigation System (LORAN)
8	OMEGA
9	Other
10	Radar Responder Beacon (RACON)
11	Radar
12	Radio
13	Radio Telephone
14	VALUE INTENTIONALLY LEFT BLANK
15	TV
16	Microwave
17	Non-Directional Radio Beacon (NDB)
18	NDB / Distance Measuring Equipment (NDB/DME)
19	Radio Range (RNG)
20	VHF Omni Directional Radio Range (VOR)
21	VHF Omni Directional (VOR/DME)
22	VHF Omni Directional (VORTAC)
23	Tactical Air Navigation Equipment (TACAN)
24	Instrument Landing system (ILS)
25	Instrument Landing system / Distance Measuring Equipment (ILS/DME)
26	Localizer (LOC)
27	Localizer / Distance Measuring Equipment (LOC/DME)
28	Simplified Directional Facility (SDF)
29	Landing Distance Available (LDA)
30	Microwave Landing System (MLS)
31	Fan Marker
32	Bone Marker
33	Radio Telegraph
34	Ground Controlled Approach (GCA)
35	Radar Antenna
36	VALUE INTENTIONALLY LEFT BLANK
37	Precision Approach Radar (PAR)
38	Aeronautical Radio
39	VALUE INTENTIONALLY LEFT BLANK
40	Radio Beacon
41	Rotating Loop Radio Beacon
42	Visual Flight Rules (VFR) Test Signal Maker
43	VALUE INTENTIONALLY LEFT BLANK
44	Consol Radio Beacon
45	Radar station
46	Aeronautical Radio Range
47	Hifix
48	Hyperfix
49	Tricolor panel
50	Radio Station
51	Radio Beacon, type unknown
52	None
53	QTG Station (R)
54	Remark
55	Radar reflector
56	Locator (LO)

Table D-5-2. DIGEST navigational system type (continued)

VALUE	DEFINITION
57	Localizer (LLZ)
58	Distance Measuring Equipment (DME)
999	Other

APPENDIX 6 TO ANNEX D. GEODETIC CODES AND PARAMETERS

INTRODUCTION

The 4 main geodetic concepts in this chapter are ellipsoid, datum, projection and grid system.

A geodetic datum includes an ellipsoid as one of its defining components. A grid system includes a datum and a projection among its defining components. The way in which geodetic datum, ellipsoid, grid and projection are inter-related is shown in Figure D-6-1.

Concept Relationship Diagram
Each arrow means "... is an input which helps to define ..."

Geodetic Datum → Grid System

Ellipsoid ↑ (to Geodetic Datum)   Projection ↑ (to Grid System)

Figure D-6-1 Concept relationships

The codes identifying ellipsoid, datum, projection and grid are listed in Tables D-6-1, D-6-2, D-6-5 and D-6-6. It should be noted that the grid codes in Table D-6-6 are allocated to both grid systems and grid categories. A grid category includes a number of different grids, with variations in geodetic datum and/or zone of application. The most obvious example is Universal Transverse Mercator.

ELLIPSOID CODES

The parameters (semimajor axis a and inverse flattening 1/f) are purely to assist ellipsoid identification. The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility. In some cases, ellipsoids have come into existence as part of a datum definition. As a result, some ellipsoids are known by the same name as the datum, although the codes will differ. Note the presence of special codes: NO for no ellipsoid, ZY for other known ellipsoid and ZZ for unknown ellipsoid.

Table D-6-1. DIGEST ellipsoid codes

ELLIPSOID	PARAMETERS (a, 1/f)	ELLIPSOID CODE
Airy (1830)	(6377563.396, 299.3249647)	AA *Alt:* AAY
US - Modified Airy UK - Airy Modified	(6377340.189, 299.3249647)	AM *Alt:* AAM
Australian National (1966)	(6378160.000, 298.2500000)	AN
APL 4.5 (1968)	(6378144.000, 298.2300000)	AP
Average Terrestrial System 1977	(6378135.000, 298.2570000)	AT
Airy (War Office)	(6377542.178, 299.3250000)	AW
Bessel (Modified)	(6377492.018, 299.1528000)	BM
Bessel 1841 (Namibia)	(6377483.865, 299.1528128)	BN
US - Bessel 1841 (Ethiopia, Indonesia, Japan, Korea) UK - Bessel (1841) Revised	(6377397.155, 299.1528128)	BR
Clarke 1858	(6378235.600, 294.2606768)	CA
Clarke 1858 (Modified)	(6378293.645, 294.2600000)	CB
Clarke 1866	(6378206.400, 294.9786982)	CC *Alt:* CLK
US - Clarke 1880 UK - Clarke 1880 Modified	(6378249.145, 293.4650000)	CD *Alt:* CLJ

Table D-6-1. DIGEST ellipsoid codes (continued)

ELLIPSOID	PARAMETERS (a, 1/f)	ELLIPSOID CODE
Clarke 1880 (Cape)	(6378249.145, 293.4663077)	CE
Clarke 1880 (Palestine)	6378300.782, 293.4663077)	CF
Clarke 1880 (IGN)	(6378249.200, 293.4660208)	CG
Clarke 1880 (Syria)	(6378247.842, 293.4663517)	CI
Clarke 1880 (Fiji)	(6378301.000, 293.4650000)	CJ
Clarke 1880 (Unspecified)	(-,-)	CL
Danish (1876) or Andrae	(6377104.430, 300.0000000	DA
Delambre 1810	(6376985.228, 308.6400000)	DB
Delambre (Carte de France)	(6376985.000, 308.6400000)	DC
US - Everest (India 1830) UK - Everest (1830)	(6377276.345, 300.8017000)	EA
US - Everest (Brunei and E. Malaysia (Sabah and Sarawak)) UK - Everest (Borneo)	(6377298.556, 300.8017000)	EB
US - Everest (India 1956) UK - Everest (India)	(6377301.243, 300.8017000) UK takes 1/f as 300.8017255.	EC
US - Everest (W. Malaysia 1969) UK - Everest (Malaya RSO)	(6377295.664, 300.8017000)	ED
US - Everest (W. Malaysia and Singapore 1948) UK - Everest (Malaya RKT)	(6377304.063, 300.8017000)	EE
Everest (Pakistan)	(6377309.613, 300.8017000)	EF
Everest (Unspecified)	(-,-)	EV
US - Modified Fischer 1960 (South Asia) UK - Fischer 1960 (South Asia)	(6378155.000, 298.3000000)	FA
Fischer 1968	(6378150.000, 298.3000000)	FC
Fischer 1960 (Mercury)	(6378166.000, 298.3000000)	FM
Germaine (Djibouti)	(6378284.000, 294.0000000)	GE
Hayford 1909 (6378388.000, 296.9592630)	The original version, based on a=6378388, b=6356909.	HA
Helmert 1906	(6378200.000, 298.3000000)	HE
Hough 1960	(6378270.000, 297.0000000)	HO
Indonesian National (1974)	(6378160.000, 298.2470000)	ID
US - International 1924 UK - International	(6378388.000, 297.0000000)	IN *Alt:* INT
Krassovsky (1940)	(6378245.000, 298.3000000)	KA *Alt:* KRA
Krayenhoff 1827	(6376950.400, 309.6500000)	KB
No ellipsoid		NO
NWL-8E	(6378145.000, 298.2500000)	NW
Plessis Modified	(6376523.000, 308.6400000)	PM
Plessis Reconstituted	(6376523.994, 308.6248070)	PR
Geodetic Reference System 1967	(6378160.000, 298.2471674)	RE
Geodetic Reference System 1980	(6378137.000, 298.2572221)	RF
South American	(6378160.000, 298.2500000)	SA
Soviet Geodetic System 1985	(6378136.000, 298.2570000)	SG
Ellipsoid Junction		SJ

Table D-6-1. DIGEST ellipsoid codes (continued)

ELLIPSOID	PARAMETERS (a, 1/f)	ELLIPSOID CODE
Soviet Geodetic System 1990	(6378136.000, 298.2578393)	SN
Struve 1860	(6378298.300, 294.7300000)	ST
Svanberg	(6376797.000, 304.2506000)	SV
Walbeck 1819 (Planheft 1942)	(6376895.000, 302.7821565)	WA
Walbeck 1819 (AMS 1963)	(6376896.000, 302.7800000)	WB
World Geodetic System 1966	(6378145.000, 298.2500000)	WC
World Geodetic System 1972	(6378135.000, 298.2600000)	WD *Alt:* WGC
World Geodetic System 1984	(6378137.000, 298.2572236)	WE *Alt:* WGE
World Geodetic System (Unspecified)	(-,-)	WF
US - War Office 1924 (McCaw) UK - War Office 1924	(6378300.000, 296.0000000)	WO
World Geodetic System 1960	(6378165.000, 298.3000000)	WS
Other Known Ellipsoid		ZY
Unknown Ellipsoid		ZZ

DATUM CODES

Table D-6-2 provides the allowable datums and their codes for the Geodetic Datum fields. Sounding Datum and the Vertical Reference System field usage are also covered in the Feature and Attribute Coding Catalogue (Part 4)In some cases a geodetic datum with a 3-letter code is followed by 4-letter codes referring to the same datum but specifying particular regions. See, for example, codes AINA and AINB which follow AIN. The 4-letter codes are not different datums, but "regional" solutions to the datum. Regional solutions represent regional variations in the relationship between the datum and WGS 1984. Use of the 4-letter code is recommended when there is a need to identify that relationship. Unless indicated otherwise at the end of the datum name, the Zero Meridian is always Greenwich. Datums with a zero meridian other than Greenwich have "1" as a 4th character in the datum code.To assist the process of matching ellipsoids to datums, ellipsoid codes are shown in the final column.The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility.

Note the presence of special codes:

- Geodetic Datums (Table D-6-2): UND for undetermined datum and ZYX for other known datum.
- Sounding Datums (Table D-6-4): ZYX for other known sounding datum and ZZZ for unknown.

Table D-6-2. DIGEST geodetic datum codes

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
Adindan	**ADI**	CD
Adindan (Ethiopia)	**ADIA**	CD
Adindan (Sudan)	**ADIB**	CD
Adindan (Mali)	**ADIC**	CD
Adindan (Senegal)	**ADID**	CD
Adindan (Burkina Faso)	**ADIE**	CD
Adindan (Cameroon)	**ADIF**	CD
Adindan (Mean value: Ethiopia and Sudan)	**ADIM**	CD
Afgooye (Somalia)	**AFG**	KA
Antigua Island Astro 1943	**AIA**	CD
Ain el Abd 1970	**AIN**	IN
Ain el Abd 1970 (Bahrain Island)	**AINA**	IN
Ain el Abd 1970 (Saudi Arabia)	**AINB**	IN
American Samoa Datum 1962	**AMA**	CC
Amersfoort 1885/1903 (Netherlands)	**AME**	BR

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
Anna 1 Astro 1965 (Cocos Islands)	**ANO**	AN
Approximate Luzon Datum (Philippines)	**APL**	CC
Arc 1950	**ARF**	CD
Arc 1950 (Botswana)	**ARFA**	CD
Arc 1950 (Lesotho)	**ARFB**	CD
Arc 1950 (Malawi)	**ARFC**	CD
Arc 1950 (Swaziland)	**ARFD**	CD
Arc 1950 (Zaire)	**ARFE**	CD
Arc 1950 (Zambia)	**ARFF**	CD
Arc 1950 (Zimbabwe)	**ARFG**	CD
Arc 1950 (Burundi)	**ARFH**	CD
Arc 1950 (Mean value: Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, and Zimbabwe)	**ARFM**	CD
Arc 1960	**ARS**	CD
Arc 1960 (Kenya)	**ARSA**	CD
Arc 1960 (Tanzania)	**ARSB**	CD
Arc 1960 (Mean value: Kenya, Tanzania)	**ARSM**	CD
Arc 1935 (Africa)	**ART**	CD
Ascension Island 1958 (Ascension Island)	**ASC**	IN
Montserrat Island Astro 1958	**ASM**	CD
Astro Station 1952 (Marcus Island)	**ASQ**	IN
Astro Beacon "E" (Iwo Jima Island)	**ATF**	IN
Average Terrestrial System 1977, New Brunswick	**ATX**	AT
Australian Geod. 1966 (Australia and Tasmania Is.)	**AUA**	AN
Australian Geod. 1984 (Australia and Tasmania Is.)	**AUG**	AN
Djakarta (Batavia) (Sumatra Island, Indonesia)	**BAT**	BN
Djakarta (Batavia) (Sumatra Island, Indonesia) with Zero Meridian Djakarta	**BAT1**	BN
Bekaa Base South End (Lebanon)	**BEK**	CG
Belgium 1950 System (Lommel Signal, Belgium)	**BEL**	IN
Bermuda 1957 (Bermuda Islands)	**BER**	CC
Bissau (Guinea-Bissau)	**BID**	IN
Bogota Observatory (Colombia)	**BOO**	IN
Bogota Observatory (Colombia) with Zero Meridian Bogota	**BOO1**	IN
Bern 1898 (Switzerland)	**BRE**	BR
Bern 1898 (Switzerland) with Zero Meridian Bern	**BRE1**	BR
Bukit Rimpah (Bangka & Belitung Islands, Indonesia)	**BUR**	BR
Cape Canaveral (Mean value: Florida and Bahama Islands)	**CAC**	CC
Campo Inchauspe (Argentina)	**CAI**	IN
Camacupa Base SW End (Campo De Aviacao, Angola)	**CAM**	CD
Canton Astro 1966 (Phoenix Islands)	**CAO**	IN
Cape (South Africa)	**CAP**	CE
Camp Area Astro (Camp McMurdo Area, Antarctica)	**CAZ**	IN
S-JTSK, Czechoslavakia (prior to 1 Jan 1993)	**CCD**	BN
Carthage (Tunisia)	**CGE**	CG
Compensation Géodétique du Québec 1977	**CGX**	CC
Chatham 1971 (Chatham Island, New Zealand)	**CHI**	IN
Chua Astro (Paraguay)	**CHU**	
Corrego Alegre (Brazil)	**COA**	IN
Conakry Pyramid of the Service Geographique (Guinea)	**COV**	CG
Guyana CSG67	**CSG**	
Dabola (Guinea)	**DAL**	CD

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
DCS-3 Lighthouse, Saint Lucia, Lesser Antilles	**DCS**	CD
Deception Island, Antarctica	**DID**	CD
GUX 1 Astro (Guadacanal Island)	**DOB**	IN
Dominica Astro M-12, Dominica, Lesser Antilles	**DOM**	
Easter Island 1967 (Easter Island)	**EAS**	IN
Wake-Eniwetok 1960 (Marshall Islands)	**ENW**	HO
European 1950 (Mean value)	**EUR**	IN
European 1950 (Western Europe: Austria, Denmark, France, Federal Republic of Germany, Netherlands, and Switzerland)	**EURA**	IN
European 1950 (Greece)	**EURB**	IN
European 1950 (Norway and Finland)	**EURC**	IN
European 1950 (Portugal and Spain)	**EURD**	IN
European 1950 (Cyprus)	**EURE**	IN
European 1950 (Egypt)	**EURF**	IN
European 1950 (England, Channel Islands, Scotland, and Shetland Islands)	**EURG**	IN
European 1950 (Iran)	**EURH**	IN
European 1950 (Sardinia)	**EURI**	IN
European 1950 (Sicily)	**EURJ**	IN
European 1950 (England, Channel Islands, Ireland, Northern Ireland, Scotland, Shetland Islands, and Wales)	**EURK**	IN
European 1950 (Malta)	**EURL**	IN
European 1950 (Mean value: Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, & Switzerland)	**EURM**	IN
European 1950 (Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Syria)	**EURS**	IN
European 1950 (Tunisia)	**EURT**	IN
European 1979 (Mean value: Austria, Finland, Netherlands, Norway? Spain, Sweden, and Switzerland)	**EUS**	IN
Oman (Oman)	**FAH**	CD
Observatorio Meteorologico 1939 (Corvo and Flores Islands, Azores)	**FLO**	IN
Fort Thomas 1955 (Nevis, St Kitts, Leeward Islands)	**FOT**	CD
GAN 1970 (Addu Atoll, Republic of Maldives)	**GAA**	IN
Gandajika Base (Zaire)	**GAN**	IN
Geodetic Datum 1949 (New Zealand)	**GEO**	IN
DOS 1968 (Gizo Island, New Georgia Islands)	**GIZ**	IN
Graciosa Base SW (Faial, Graciosa, Pico, Sao Jorge, and Terceira Island, Azores)	**GRA**	IN
Greek Datum, Greece	**GRK**	BR
Greek Geodetic Reference System 1987 (GGRS 87)	**GRX**	RF
Gunong Segara (Kalimantan Island, Indonesia)	**GSE**	BR
Gunong Serindung	**GSF**	BR
Guam 1963	**GUA**	CC
Herat North (Afganistan)	**HEN**	IN
Hermannskogel	**HER**	BR
Provisional South Chilean 1963 (or Hito XVIII 1963) (S. Chile, 53°S)	**HIT**	IN
Hjörsey 1955 (Iceland)	**HJO**	IN
Hong Kong 1963 (Hong Kong)	**HKD**	IN
Hong Kong 1929	**HKO**	CA
Hu-Tzu-Shan	**HTN**	IN

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
Hungarian 1972	**HUY**	RE
Bellevue (IGN) (Efate and Erromango Islands)	**IBE**	IN
Indonesian 1974	**IDN**	ID
Indian	**IND**	
Indian (Thailand and Vietnam)	**INDA**	
Indian (Bangladesh)	**INDB**	EA
Indian (India and Nepal)	**INDI**	EC
Indian (Pakistan)	**INDP**	EF
Indian (1954)	**INF**	EA
Indian 1954 (Thailand)	**INFA**	EA
Indian 1960	**ING**	EA
Indian 1960 (Vietnam: near 16°N)	**INGA**	EA
Indian 1960 (Con Son Island (Vietnam))	**INGB**	EA
Indian 1975	**INH**	EA
Indian 1975 (Thailand)	**INHA**	EA
Ireland 1965 (Ireland and Northern Ireland)	**IRL**	AM
ISTS 061 Astro 1968 (South Georgia Islands)	**ISG**	IN
ISTS 073 Astro 1969 (Diego Garcia)	**IST**	IN
Johnston Island 1961 (Johnston Island)	**JOH**	IN
Kalianpur (India)	**KAB**	EC
Kandawala (Sri Lanka)	**KAN**	EA
Kertau 1948 (or Revised Kertau) (West Malaysia and Singapore)	**KEA**	EE
KCS 2, Sierra Leone	**KCS**	WO
Kerguelen Island 1949 (Kerguelen Island)	**KEG**	IN
Korean Geodetic System (Coree Du Sud)	**KGS**	RF
KKJ (or Kartastokoordinaattijarjestelma), Finland	**KKX**	IN
Kusaie Astro 1951	**KUS**	IN
Kuwait Oil Company (K28)	**KUW**	CD
L.C. 5 Astro 1961 (Cayman Brac Island)	**LCF**	CC
Leigon (Ghana)	**LEH**	CG
Liberia 1964 (Liberia)	**LIB**	CD
Lisbon (Castelo di São Jorge), Portugal	**LIS**	
Local Astro.	**LOC**	
Loma Quintana (Venezuela)	**LOM**	IN
Luzon	**LUZ**	CC
Luzon (Philipines except Mindanao Island)	**LUZA**	CC
Luzon (Mindanao Island)	**LUZB**	CC
Marco Astro (Salvage Islands)	**MAA**	IN
Martinique Fort-Desaix	**MAR**	IN
Massawa (Eritrea, Ethiopia)	**MAS**	BR
Manokwari (West Irian)	**MAW**	
Mayotte Combani	**MCX**	
Mount Dillon, Tobago	**MDT**	
Merchich (Morocco)	**MER**	CG
Midway Astro 1961 (Midway Island)	**MID**	IN
Mahe 1971 (Mahe Island)	**MIK**	CD
Minna	**MIN**	CD
Minna (Cameroon)	**MINA**	CD
Minna (Nigeria)	**MINB**	CD
Mannheim (Germany)	**MNM**	

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
Rome 1940 (or Monte Mario 1940), Italy	**MOD**	IN
Rome 1940 (or Monte Mario 1940), Italy, with Zero Meridian Rome	**MOD1**	IN
Montjong Lowe	**MOL**	BR
M'Poraloko (Gabon)	**MPO**	CD
Viti Levu 1916 (Viti Levu Island, Fiji Islands)	**MVS**	CD
Nahrwan	**NAH**	CD
Nahrwan (Masirah Island, Oman)	**NAHA**	CD
Nahrwan (United Arab Emirates)	**NAHB**	CD
Nahrwan (Saudi Arabia)	**NAHC**	CD
Naparima (BWI Trinidad and Tobago)	**NAP**	IN
North American 1983	**NAR**	RF
North American 1983 (Alaska, excluding Aleutian Islands)	**NARA**	RF
North American 1983 (Canada)	**NARB**	RF
North American 1983 (CONUS)	**NARC**	RF
North American 1983 (Mexico and Central America))	**NARD**	RF
North American 1983 (Aleutian Islands)	**NARE**	RF
North American 1983 (Hawaii)	**NARH**	RF
North American 1927 (Mean value)	**NAS**	CC
North American 1927 (Eastern US)	**NASA**	CC
North American 1927 (Western US)	**NASB**	CC
North American 1927 (Mean value: CONUS)	**NASC**	CC
North American 1927 (Alaska)	**NASD**	CC
North American 1927 (Mean value: Canada)	**NASE**	CC
North American 1927 (Alberta and British Columbia)	**NASF**	CC
North American 1927 (Newfoundland, New Brunswick, Nova Scotia and Quebec)	**NASG**	CC
North American 1927 (Manitoba and Ontario)	**NASH**	CC
North American 1927 (Northwest Territories and Saskatchewan)	**NASI**	CC
North American 1927 (Yukon)	**NASJ**	CC
North American 1927 (Mexico)	**NASL**	CC
North American 1927 (Central America - Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua)	**NASN**	CC
North American 1927 (Canal Zone)	**NASO**	CC
North American 1927 (Caribbean, Barbados, Caicos Islands, Cuba, Dominican Republic, Grand Cayman, Jamaica, Leeward Islands, and Turks Islands)	**NASP**	CC
North American 1927 (Bahamas, except San Salvador Island)	**NASQ**	CC
North American 1927 (San Salvador Island)	**NASR**	CC
North American 1927 (Cuba)	**NAST**	CC
North American 1927 (Hayes Peninsula, Greenland)	**NASU**	CC
North American 1927 (Aleutian Islands East of 180°W)	**NASV**	CC
North American 1927 (Aleutian Islands West of 180°W)	**NASW**	CC
New French or Nouvelle Triangulation Française (NTF) with Zero Meridian Paris	**NFR1** ***Alt:* FDA**	CG
North Sahara 1959	**NSD**	CD
Ocotopeque, Guatemala	**OCO**	
Belgium 1972 (Observatoire d'Uccle)	**ODU**	IN
Old Egyptian (Egypt)	**OEG**	HE
Ordnance Survey of Great Britain	**OGB**	AA
Ordnance Survey G.B. 1936 (England)	**OGBA**	AA
Ordnance Survey G.B. 1936 (England, Isle of Man, and Wales)	**OGBB**	AA

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
Ordnance Survey G.B. 1936 (Scotland and Shetland Islands)	**OGBC**	AA
Ordnance Survey G.B. 1936 (Wales)	**OGBD**	AA
Ordnance Survey G.B. 1936 (Mean value: England, Isle of Man, Scotland, Shetland, and Wales)	**OGBM**	AA
Old Hawaiian	**OHA**	CC
Old Hawaiian (Hawaii)	**OHAA**	CC
Old Hawaiian (Kauai)	**OHAB**	CC
Old Hawaiian (Maui)	**OHAC**	CC
Old Hawaiian (Oahu)	**OHAD**	CC
Old Hawaiian (Mean value)	**OHAM**	CC
Oslo Observatory (Old), Norway	**OSL**	BR
Padang Base West End (Sumatra, Indonesia)	**PAD**	BR
Padang Base West End (Sumatra, Indonesia) with Zero Meridian Djakarta	**PAD1**	BR
Palestine 1928 (Israel, Jordan)	**PAL**	CF
Potsdam or Helmertturm (Germany)	**PDM**	IN
Ayabelle Lighthouse (Djibouti)	**PHA**	CD
Pitcairn Astro 1967 (Pitcairn Island)	**PIT**	IN
Pico de las Nieves (Canary Islands)	**PLN**	IN
SE Base (Porto Santo) (Porto Santo & Madeira Islands)	**POS**	IN
Provisional South American 1956	**PRP**	IN
Prov. S. American 1956 (Bolivia)	**PRPA**	IN
Prov. S. American 1956 (Northern Chile near 19°S)	**PRPB**	IN
Prov. S. American 1956 (Southern Chile near 43°S)	**PRPC**	IN
Prov. S. American 1956 (Columbia)	**PRPD**	IN
Prov. S. American 1956 (Ecuador)	**PRPE**	IN
Prov. S. American 1956 (Guyana)	**PRPF**	IN
Prov. S. American 1956 (Peru)	**PRPG**	IN
Prov. S. American 1956 (Venezuela)	**PRPH**	IN
Prov. S. American 1956 (Mean value: Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, & Venezuela)	**PRPM**	IN
Point 58 Mean Solution (Burkina Faso and Niger)	**PTB**	CD
Pointe Noire 1948	**PTN**	CD
Pulkovo 1942 (Russia)	**PUK**	KA
Puerto Rico (Puerto Rico and Virgin Islands)	**PUR**	CC
Qatar National (Qatar)	**QAT**	IN
Qornoq (South Greenland)	**QUO**	IN
Rauenberg (Berlin, Germany)	**RAU**	BR
Reconnaissance Triangulation, Morocco	**REC**	CG
Reunion 1947	**REU**	IN
Revised Nahrwan	**NAX**	CD
RT90, Stockholm, Sweden	**RTS**	BR
Santo (DOS) 1965 (Espirito Santo Island)	**SAE**	IN
South African (South Africa)	**SAF**	CD
Sainte Anne I 1984 (Guadeloupe)	**SAG**	
South American 1969	**SAN**	SA
South American 1969 (Argentina)	**SANA**	SA
South American 1969 (Bolivia)	**SANB**	SA
South American 1969 (Brazil)	**SANC**	SA
South American 1969 (Chile)	**SAND**	SA
South American 1969 (Columbia)	**SANE**	SA
South American 1969 (Ecuador)	**SANF**	SA

Table D-6-2. DIGEST geodetic datum codes (continued)

GEODETIC DATUMS (Horizontal Datums can also be used as Vertical Datums)	DATUM CODE	ELLIPSOID CODE
South American 1969 (Guyana)	**SANG**	SA
South American 1969 (Paraguay)	**SANH**	SA
South American 1969 (Peru)	**SANI**	SA
South American 1969 (Baltra, Galapagos Islands)	**SANJ**	SA
South American 1969 (Trinidad and Tobago)	**SANK**	SA
South American 1969 (Venezuela)	**SANL**	SA
South American 1969 (Mean value: Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Guyana, Paraguay, Peru, Trinidad, Tobago, and Venezuela)	**SANM**	SA
Sao Braz (Sao Miguel, Santa Maria Islands, Azores)	**SAO**	IN
Sapper Hill 1943 (East Falkland Islands)	**SAP**	IN
Schwarzeck (Namibia)	**SCK**	BN
Soviet Geodetic System 1985	**SGA**	SG
Soviet Geodetic System 1990	**SGB**	SG
Selvagem Grande 1938 (Salvage Islands)	**SGM**	IN
Astro Dos 71/4 (St. Helena Island)	**SHB**	IN
Sierra Leone 1960	**SIB**	CD
South Asia (Southeast Asia, Singapore)	**SOA**	FA
S-42 (Pulkovo 1942)	**SPK**	KA
St. Pierre et Miquelon 50	**SPX**	
Stockholm 1938 (Sweden)	**STO**	BR
Sydney Observatory, New South Wales, Australia	**SYO**	CB
Tananarive Observatory 1925	**TAN**	IN
Tananarive Observatory 1925, with Zero Meridian Paris	**TAN1**	IN
Tristan Astro 1968 (Tristan da Cunha)	**TDC**	IN
Timbalai 1948 (Brunei and East Malaysia - Sarawak and Sabah)	**TIL**	EB
Timbali 1968	**TIN**	
Tokyo	**TOY**	BR
Tokyo (Japan)	**TOYA**	BR
Tokyo (Korea)	**TOYB**	BR
Tokyo (Okinawa)	**TOYC**	BR
Tokyo (Mean value: Japan, Korea, and Okinawa)	**TOYM**	BR
Trinidad 1903	**TRI**	CA
Astro Tern Is. 1961 (Tern Island, Hawaii)	**TRN**	IN
Tübingen (Germany)	**TUB**	
Undetermined (processed as if WGS 84)	**UND**	
Voirol 1875	**VOI**	CG
Voirol 1875 with Zero Meridian Paris	**VOI1**	CG
Voirol 1960, Algeria	**VOR**	CG
Voirol 1960, Algeria, with Zero Meridian Paris	**VOR1**	CG
Wake Island Astro 1952	**WAK**	
World Geodetic System 1960	**WGA**	WS
World Geodetic System 1966	**WGB**	WC
World Geodetic System 1972	**WGC**	WD
World Geodetic System 1984	**WGE**	WE
Yacare (Uruguay)	**YAC**	IN
Zanderij (Surinam)	**ZAN**	IN
Other Known Datum	**ZYX**	

Table D-6-3. DIGEST codes for vertical datums

VERTICAL DATUM REFERENCE	CODE
Geodetic (see Note 1)	GEOD
Mean Sea Level (see Note 2) with identification Example: Mean Sea Level Singapore	MSL

Note 1. All elevations in the dataset are referenced to the ellipsoid of the specified geodetic datum.

Note 2. All elevations in the dataset are referenced to the measured geoid of the specified datum.

Table D-6-4. DIGEST codes for sounding datums

SOUNDING DATUM	CODE
Approximate Lowest Astronomical Tide	ALAT
Approximate Mean Low Water Tide	AMLLW
Approximate Mean Low Water	AMLW
Approximate Mean Low Water Springs	AMLWS
Approximate Mean Sea Level	AMSL
Chart Datum (Unspecified)	CD
Equinoctial Spring Low Water	ESLW
Highest Astronomical Tide	HAT
Higher High Water Large Tide	HHWLT
Highest Normal High Water	HNHR
Higher High Water	HRHW
Highest High Water	HTHW
High Water	HW
High Water Springs	HWS
International Great Lakes Datum 1985	IGLD
Indian Spring High Water	ISHW
Indian Spring Low Water	ISLW
Lowest Astronomical Tide	LAT
Local Datum (arbitrary datum defined by local harbour authority)	LD
Lower Low Water Large Tide	LLWLT
Lowest Low Water Springs	LLWS
Lower Low Water	LRLW
Lowest Low Water	LTLW
Low Water	LW
Low Water Springs	LWS
Mean Higher High Water	MHHW
Mean Higher Water	MHRW
Mean High Water	MHW
Mean High Water Neaps	MHWN
Mean High Water Springs	MHWS
Mean Lower Low Water	MLLW
Mean Lower Low Water Springs	MLLWS
Mean Low Water	MLW
Mean Low Water Neaps	MLWN
Mean Low Water Springs	MLWS
Mean Sea	MSL
Mean Tide Level	MTL
Nearly Lowest Low Water	NLLW
Neap Tide	NT
Spring Tide	ST
VALUE INTENTIONALLY LEFT BLANK	VILB
Other Known Sounding Datum	ZYX
Unknown	ZZZ

PROJECTION CODE AND PARAMETERS

Table D-6-5 provides the allowable projections and their codes and parameters for the Dataset Map Projection Group. These codes and parameters are necessary for conversion of geographic coordinates to/from grid coordinates (as used on a map).

Note that Easting False Origin and Northing False Origin are also needed. The abbreviation "*Alt:*" is used to denote alternative codes originating from DIGEST 1.2, which are included for backward compatibility.

Note the presence of a special code ZY for other known projection.

Table D-6-5. DIGEST projection codes and parameters

PROJECTION	PROJ'N CODE	PARAMETERS 1	2	3	4
Albers Equal-Area Conic	AC	Longitude of Origin	Std. Parallel Nearer to Equator	Std. Parallel Farther from Equator	Latitude of Origin *(see Note 5)*
(Lambert) Azimuthal Equal-Area	AK	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Azimuthal Equidistant	AL	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Bonne	BF	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	-
Equirectangular (La Carte Parallélogramatique)	CC	Longitude of Central Meridian	Latitude of True Scale	-	-
Equidistant Conic with 1 Standard Parallel	CP	Longitude of Central Meridian	Latitude of Proj. Origin	Latitude of Standard Parallel	-
Cassini-Soldner	CS	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Gnomonic	GN	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Hotine Oblique Mercator based on 2 Points	HX	Scale Factor at Proj. Origin	Latitude of Proj. Origin	Longitude of 1st Point defining Central Line	Latitude of 1st Point defining Central Line
(Note the 5th and 6th Parameters shown right.)		Longitude of 2nd Point defining Central Line	Latitude of 2nd Point defining Central Line	-	-
Equidistant Conic with 2 Standard Parallels	KA	Longitude of Central Meridian	Latitude of Origin *(see Note 5)*	Latitude of Standard Parallel Nearer to Equator	Latitude of Standard Parallel Farther from Equator
Laborde	LA	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	-
Lambert Conformal Conic *(see Note 1)*	LE	Longitude of Origin	Std. Parallel Nearer to Equator	Std Parallel Farther from Equator	Latitude of Origin *(see Note 5)*
Lambert Equal-Area Meridional	LJ	Longitude of Central Meridian	Latitude of Proj. Origin	-	-
Mercator	MC	Longitude of Central Meridian	Latitude of True Scale	-	-

Table D-6-5. DIGEST projection codes and parameters (continued)

PROJECTION	PROJ'N CODE	PARAMETERS			
		1	2	3	4
Miller Cylindrical	MH	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
French Lambert	MJ	Longitude of Proj. Origin	Latitude of Proj. Origin	Scale Factor at Proj. Origin	-
New Zealand Map Grid	NT	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Oblique Mercator	OC	Longitude of Reference Point on Great Circle	Latitude of Reference Point on Great Circle	Azimuth of Great Circle at Reference Point	-
Orthographic	OD	Longitude of Proj. Origin	Latitude of Proj. Origin	-	-
Polar Stereographic	PG	Central Meridian (Longitude straight down from Pole on map)	Latitude of True Scale	-	-
Polyconic	PH	Longitude of Central Meridian	Latitude of Proj. Origin	-	-
Relative Coordinates	RC	X-Scale Factor	Y-Scale Factor	-	-
Hotine Oblique Mercator (Rectified Skew Orthomorphic)	RS *Alt:* RB	Longitude of Proj. Origin	Latitude of Proj. Origin	Azimuth East of North for Central Line (Skew X-Axis) at Proj. Origin	Scale Factor at Proj. Origin
Robinson	RX	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Sinusoidal	SA	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
Oblique Stereographic	SD	Longitude of Origin	Latitude of Origin	Scale factor at Origin	-
Space Oblique Mercator	SX	Application Code *(see Note 3)*	Vehicle Number *(see Note 4)*	Orbital Path Number *(see Note 4)*	
Transverse Mercator	TC	Longitude of Central Meridian	Central Scale Factor	Latitude of Origin *(see Note 5)*	-
Van der Grinten	VA	Longitude of Central Meridian	Radius of Sphere *(see Note 2)*	-	-
General Vertical Near-Side Perspective	VX	Longitude of Proj. Origin	Latitude of Proj. Origin	Height of Perspective Point above Surface (in metres)	-
Other Known Projection	ZY	-	-	-	-

Note 1. The parameters of the Lambert Conformal Conic projection are based on the version derived from 2 Standard Parallels. Where the projection is derived from a single standard parallel with a scale factor, data producers need to compute the equivalent parameters for the 2-standard-parallel case.

Note 2. This radius can be omitted if the chosen sphere has the same surface area as the chosen ellipsoid. The radius R which has that property may be derived from the ellipsoid parameters as follows:

Compute e^2 and e from $e^2 = 2*f - f^2$.

$Qp = 1 - ((1-e^2)/(2*e)) * Ln((1-e)/(1+e))$.

$R = a*Sqrt(Qp/2)$.

Note 3. Application Code:

1 = “Landsat, USGS equations”
2 = “Landsat, EOSAT equations.”
(Other values to be added as and when required.)

Note 4. These parameters combined with the Application Code determine the mathematical parameters used in the projection.

Note 5. The Origin included here is the point where Easting False Origin and Northing False Origin are applied, rather than the Projection Origin.

GRID CODES

Table D-6-6 provides the allowable grids and their codes for the Grid System field. To assist the process of matching datums and projections to grids, datum codes and projection codes are shown in the last 2 columns. It should be noted that some of the entries are **grid categories**, that is to say there is more than one possible grid. This can be due to more than one possible datum or more than one possible zone, or indeed both. In a small number of cases, a grid category covers zones which use different projections. Grid categories are marked with a dagger (†). In the context of a DIGEST dataset, the possible ambiguity of a grid category is resolved when the datum, projection and the values of the projection parameters are specified. Zone number may also be specified to improve identification. Note the presence of special code MS for other known grid.

Table D-6-6. DIGEST grid codes
(“†” annotations are explained at the end of the table)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ’N CODE
Aden Zone	**AD**		LE
Afghanistan Gauss-Krüger Grid	**AF**		TC
Air Defense Grid	**AG**		
Air Support Grid	**AI**		
Alabama Coordinate System†[6] *(see Note 2)*	**AJ**		TC
Alaska Coordinate System†[6] *(see Notes 1 and 2)*	**AK**		
Algeria Zone †[6]	**AL**		MJ
Albania Bonne Grid	**AM**		BF
Alpha-Numeric (Atlas) Grid	**AN**		
Arbitrary Grid	**AO**		
American Samoa Coordinate System†[6]	**AP**		LE
Argentine Gauss-Krüger Conformal Grid†[6]	**AQ**		TC
Artillery Referencing System	**AR**		
Arizona Coordinate System†[6] *(see Note 2)*	**AS**		TC
Australia Belt †[6]	**AU**		TC
Arkansas Coordinate System†[6] *(see Note 2)*	**AV**		LE
Australian Map Grid†[6]	**AW**		TC
Azores Gauss Conformal Grid	**AX**	LOC	TC
Azores Zone	**AZ**	LOC	LE
Baku 1927 Coordinate System	**BA**		
Bavaria Soldner Coordinate System	**BB**		

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
Belgium Lambert Grid†[6]	**BC**		
Belgium Bonne Grid	**BE**		BF
Brazil Gauss Conformal Grid†[6]	**BF**		TC
Soldner-Berlin (Müggelberg) Grid	**BL**	RAU	
Borneo Rectified Skew Orthomorphic Grid†[6]	**BO**		RS
British West Indies Grid†[6]	**BW**		TC
California Coordinate System†[6] *(see Note 2)*	**CB**		LE
Canada British Modified Grid	**CD**		
Ceylon Belt (Transverse Mercator)	**CE**	IND	TC
Canary Islands (Spanish Lambert Grid)	**CF**		
Chile Gauss Conformal Grid†[6]	**CG**		TC
China Belt †[6]	**CH**		TC
Canary Islands Zone	**CI**		LE
China Lambert Zone	**CJ**		LE
Colorado Coordinate Zone†[6] *(see Note 2)*	**CK**		LE
Connecticut Coordinate System†[6]	**CM**		LE
Caspian Zone	**CN**		LE
Costa Rica Lambert Grid	**CO**	OCO	LE
Crimea Grid	**CQ**		LE
Crete Zone	**CR**		LE
Cuba Lambert Grid†[6]	**CT**	NAS	LE
Caucasus Zone	**CU**	NAH	LE
Cape Verde Islands Zone	**CV**		LE
British Cassini Grid†[6]	**CW**	OGB	CS
Czechoslovak Uniform Cadastral Coordinate System	**CX**		
Cyprus Grid †[6]	**CY**		CS
Czechoslovak Military Grid	**CZ**	HER	OG
Danube Zone	**DA**	GRK	LE
Dahomey Belt	**DB**		
Denmark General Staff Grid	**DC**		
Delaware Coordinate System†[6]	**DD**		TC
Dominican Lambert Grid	**DE**		LE
Denmark Geodetic Institute System 1934	**DJ**		BE
Cape Verde Peninsula Grid	**DK**		
East Africa Belt†[6]	**EA**		TC
English Belt	**EB**		TC
Egypt Gauss Conformal Grid†[6]	**ED**		TC
El Salvador Lambert Grid	**EE**		LE
Estonian Grid	**EF**		
Hungarian Unified National Mapping System (EOTR)	**EO**	HUY	TC
Egypt Purple Belt	**EP**		TC
Egypt Red Belt†[6]	**ER**		TC
Egypt 35 Degree Belt	**ET**	OEG	
Fernando Poo Gauss Grid	**FA**		
Fiji Grid	**FB**		
Florida Coordinate System†[6] *(see Notes 1 and 2)*	**FC**		
French Bonne Grid	**FD**		BF
French Guiana Gauss Grid	**FE**		TC
French Somaliland Gauss-Laborde Grid	**FF**		
French Indochina Grid	**FI**		
Franz Josef Land Zone	**FJ**		LE
French Lambert Grid†[6]	**FL**		MJ

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
Formosa (Taiwan) Gauss-Schreiber Coordinate System	**FO**		
French Equatorial Africa Grid	**FS**		
Gabon Belt †[6]	**GA**		TC
Gauss-Boaga Grid (Transverse Mercator)	**GB**	EUR	TC
Gabon Gauss Conformal Grid	**GC**		TC
Geographic Reference System (GEOREF)†[6]	**GE**		
Guadeloupe Gauss-Laborde Grid	**GF**		
Colombia Gauss Conformal Grid	**GG**	BOO	TC
Sweden Gauss-Hannover Grid	**GH**		TC
Georgia Coordinate System†[6] *(see Note 2)*	**GI**		TC
Gauss-Krüger Grid (Transverse Mercator)†[6]	**GK**		TC
Greece Azimuthal Grid	**GL**		
German Army Grid (DHG)†[6]	**GN**		TC
Ghana National Grid	**GO**		TC
Greece Bonne Grid	**GP**		BF
Greece Conical Mecklenburg Coordinates	**GQ**		LE
Greece Conical Mecklenburg Coordinate (New Numbering)	**GR**		LE
Greenland Lambert Grid	**GT**	NAS	LE
Guinea Zone	**GU**		LE
Guam Coordinate System	**GV**		
Guatemala Lambert Grid	**GW**		LE
Guyana Transverse Mercator Grid	**GY**	LOC	TC
Haiti Lambert Grid	**HB**		LE
Hawaii Coordinate System†[6] *(see Note 2)*	**HC**		TC
Hawaii Grid	**HD**		
Honduras Lambert Grid	**HE**		LE
Hong Kong New System Cassini Grid	**HF**	HKO	CS
Hungary Stereographic Grid	**HG**	LOC	
Hong Kong Colony Grid	**HR**		
Idaho Coordinate System†[6] *(see Note 2)*	**IA**		TC
Illinois Coordinate System†[6] *(see Note 2)*	**IB**		TC
Indiana Coordinate System†[6] *(see Note 2)*	**IC**		TC
Indonesia Mercator Grid	**ID**		MC
Indonesia Polyhedric Grid†[6]	**IE**		
Iowa Coordinate System†[6] *(see Note 2)*	**IF**		LE
Ivory Coast Azimuthal Grid	**IG**		
Irish Cassini Grid	**IH**	EUR	CS
Ivory Coast Belt	**IJ**		
Irish Transverse Mercator Grid	**IK**	IRL	TC
Iceland New Lambert Zone	**IL**	HJO	LE
India Zone †[6]	**IN**		LE
Iberian Peninsula Zone	**IP**		LE
Iraq Zone †[6]	**IQ**		LE
Iraq National Grid	**IR**		TC
Italy Zone †[6]	**IT**		LE
Ivy - Found on an HA in Marshall Islands	**IY**		
Iceland Zone	**IZ**	HJO	LE
Jamaica Foot Grid	**JA**		LE
Japan Plane-Rectangular Coordinate System	**JB**		
Japan Gauss-Schreiber Grid	**JC**		
Jamaica National Grid (metric)	**JM**		LE
Johore Grid	**JO**		CS

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
Austria Gauss-Krüger Grid	**KA**		TC
Bulgaria Gauss-Krüger Grid	**KB**		TC
Katanga Grid	**KC**		
Kansas Coordinate System†[6] *(see Note 2)*	**KD**		LE
Kentucky Coordinate System†[6] *(see Note 2)*	**KE**		LE
Finland Gauss-Krüger Grid	**KF**		TC
German Gauss-Krüger Grid	**KG**		TC
Kenya Colony Grid	**KH**		CS
Korea Gauss-Schreiber Coordinate System	**KJ**		
Louisiana Coordinate System†[6] *(see Note 2)*	**KK**		LE
Lithuania Gauss-Krüger Grid	**KL**		TC
Kwantung Province Grid	**KN**		
Turkey Gauss-Krüger Grid	**KT**		TC
Kwangsi Province Grid	**KW**		
Luxembourg Gauss-Krüger Grid	**KX**	EUR	TC
Lambert Conformal Conic Grid†[6]	**LC**		
Latvia Coordinate System	**LD**		
Levant Zone	**LE**	EUR	MJ
Levant Stereographic Grid	**LF**		
Liberia Rectified Skew Orthomorphic Grid	**LG**		RS
Libya Zone	**LI**	EUR	LE
Sirte (Libya) Lambert Grid	**LL**		LE
Malaya Grid †[6]	**MA**		CS
Malta Belt	**MB**	LOC	TC
Maldive-Chagos Belt	**MC**		TC
Madiera Zone	**MD**		LE
Mediterranean Zone †[6]	**ME**		LE
Maine Coordinate System†[6] *(see Note 2)*	**MF**		TC
Malaya Rectified Skew Orthomorphic (Yard) Grid	**MG**	KEA	RS
Martinique Gauss Grid	**MH**		TC
Maryland Coordinate System†[6]	**MI**		LE
Massachusetts Coordinate System†[6] *(see Note 2)*	**MJ**		LE
Mexican Lambert Grid	**MK**		LE
Michigan Coordinate System†[6] *(see Notes 1 and 2)*	**ML**		
Mecca-Muscat Zone	**MM**		LE
Minnesota Coordinate System†[6] *(see Note 2)*	**MN**		LE
Madagascar Grid (Laborde)	**MO**	TAN	LA
Mississippi Coordinate System†[6] *(see Note 2)*	**MP**		TC
Morocco Zone †[6]	**MQ**		MJ
Other Known Grid	**MS**		
Missouri Coordinate System†[6] *(see Note 2)*	**MT**		TC
Mauritius Zone	**MU**		LE
Montana Coordinate System†[6] *(see Note 2)*	**MV**		LE
Mozambique Lambert Grid	**MW**		LE
Mozambique Polyconic Grid	**MX**		PH
Northwest Africa Zone	**NA**	MER	LE
New Jersey Coordinate System†[6]	**NB**		TC
Nigeria Colony Belt†[6]	**NC**		TC
National Grid of Great Britain	**ND**	OGB	TC
Northern European Zone †[6]	**NE**		LE
Nebraska Coordinate System†[6] *(see Note 2)*	**NF**		LE
Numeric Grid	**NG**		

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
New Hampshire Coordinate System†[6]	**NH**		TC
Niger Zone	**NI**		LE
Netherlands Stereographic Grid (Old Numbering)	**NJ**		
North Korea Gauss-Krüger Grid	**NK**		TC
Netherlands Stereographic Grid (New Numbering)	**NL**	PDM	
Netherlands East Indies Equatorial Zone British Metric Grid (Lambert) †[6]	**NM**		MC
Nord de Guerre Zone†[6]	**NO**		MJ
New Mexico Coordinate System†[6] *(see Note 2)*	**NN**		TC
Nevada Coordinate System†[6] *(see Note 2)*	**NP**		TC
New Sierra Leone Colony Grid†[6]	**NQ**		
New York Coordinate System†[6] *(see Notes 1 and 2)*	**NR**		
Netherlands East Indies Southern Zone	**NS**		LE
New Zealand Map Grid (NZMG)	**NT**	GEO	NT
Nicaragua Lambert Grid†[6]	**NU**		LE
Niger Belt	**NV**		LE
North Carolina Coordinate System†[6]	**NW**		LE
North Dakota Coordinate System†[6] *(see Note 2)*	**NX**		LE
Netherlands East Indies Equatorial Zone US Yard Grid†[6]	**NY**		LE
New Zealand Belt†[6]	**NZ**		TC
Northern Malaya Grid	**OA**		
Norway Gauss-Krüger Grid†[6]	**OB**	OSL	TC
Ohio Coordinate System†[6] *(see Note 2)*	**OD**		LE
Oklahoma Coordinate System†[6] *(see Note 2)*	**OE**		LE
Orange Report Net	**OR**	NAS	
Oregon Coordinate System†[6] *(see Note 2)*	**OS**		LE
Palestine Belt †[6]	**PA**		TC
Panama Lambert Grid	**PB**		LE
Palestine Civil Grid (Cassini)†[6]	**PC**		CS
Paraguay Gauss-Krüger Grid	**PD**		TC
Peiping Coordinate System of 1954	**PE**		
Pennsylvania Coordinate System†[6] *(see Note 2)*	**PF**		LE
Peru Polyconic Grid	**PI**		PH
Philippine Plane Coordinate System	**PJ**	LUZ	PH
Poland Gauss-Krüger Grid	**PK**		TC
Poland Quasi-Stereographic Grid	**PL**		
Philippine Polyconic Grid	**PP**	APL	PH
Portugal Bonne Grid, Old	**PQ**		BF
Portugal Bonne Grid, New	**PR**		BF
Portugal Gauss Grid	**PS**	LIS	TC
Puerto Rico & Virgin Islands Coordinate System†[6]	**PT**		LE
Puerto Rico Lambert Grid	**PU**		LE
Qatar Cassini Grid	**QA**		CS
Qatar Peninsula Grid (or Qatar National Grid (TM))	**QU**	QAT	TC
Russian Belt †[6]	**RB**	EUR	TC
Reunion Gauss Grid	**RC**		TC
Rhode Island Coordinate System†[6]	**RD**		TC
Romania Bonne Grid	**RE**		BF
Soviet Coordinate System of 1942†[6]	**RF**	PUK	TC
Romania Lambert-Cholesky Grid	**RH**		
Rikets National Grid†[6]	**RK**	STO	TC
Romania Stereographic Grid	**RI**		SD

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
Pulkovo Coordinate System of 1932	**RT**		
South Africa Belt (yards)†[6]	**SA**		TC
Senegal Gauss Conformal Grid (Belt)	**SB**		TC
South Africa Coordinate System (South Africa Belt (English feet)) †[6]	**SD**		TC
Senegal Belt	**SE**		TC
South Carolina Coordinate System†[6] *(see Note 2)*	**SF**		LE
Sahara Zone	**SH**		LE
South Dakota Coordinate System†[6] *(see Note 2)*	**SI**		LE
South Libya Zone	**SJ**		LE
Sarawak Grid	**SK**		CS
Spain Lambert Grid	**SL**	EUR	LE
Southern New Guinea Grid†[6]	**SN**		LE
South Georgia Lambert Grid	**SQ**		LE
South Syria Lambert Grid	**SR**		LE
Spanish North-Morocco Lambert Grid	**SS**		LE
Svalbard Gauss-Krüger Grid	**SV**		TC
Svobodny 1935 Coordinate System	**SX**		
Seychelles Belt	**SY**		TC
Spitzbergen Zone	**SZ**		LE
Tanganyika Territorial Grid	**TA**		
Tashkent 1875 Coordinate System	**TB**		
Tennessee Coordinate System†[6]	**TC**		LE
Texas Coordinate System†[6] *(see Note 2)*	**TD**		TC
Tobago Grid	**TE**	MDT	CS
Trinidad Grid	**TF**		CS
Trucial Coast Cassini Grid	**TG**		CS
Trucial Coast Transverse Mercator Grid	**TH**		TC
Turkey Bonne Grid	**TI**		BF
Tunisia Zone †[6]	**TN**		MJ
Uganda Cassini Coordinate System†[6]	**UA**		CS
Unidentified Grid	**UB**		
Uruguay Gauss-Krüger Grid	**UC**		TC
Utah Coordinate System†[6] *(see Note 2)*	**UD**		LE
Universal Polar Stereographic System†[6] *(Note: 61 is recommended Zone Number for Northern Polar Zone, -61 for Southern Polar Zone)*	**UP**		PG
U.S. Polyconic Grid System	**US**	NAS	PH
Universal Transverse Mercator†[6] *(Note: 1 to 60 are recommended Zone Numbers for Northern Zones, -1 to -60 for Southern Zones)*	**UT**		TC
Vermont Coordinate System†[6]	**VA**		TC
Virginia Coordinate System†[6] *(see Note 2)*	**VB**		LE
Venezuela Modified Lambert Grid	**VE**		
Vietnam Azimuthal Grid	**VI**		
West Malaysia Rectified Skew Orthomorphic (Metric) Grid	**WA**		RS
Switzerland Bonne Grid	**WB**		BF
Switzerland Conformal Oblique Cylindrical Grid	**WC**		OC
West Virginia Coordinate System†[6]	**WD**		LE
Wisconsin Coordinate System†[6]	**WE**		LE
Wyoming Coordinate System†[6]	**WF**		TC
Washington Coordinate System†[6] *(see Note 2)*	**WH**		TC

Table D-6-6. DIGEST grid codes (continued)

GRID DESCRIPTION	GRID CODE	DATUM CODE	PROJ'N CODE
World Polyconic System	**WP**		PH
Yugoslavia Gauss-Krüger Grid (Not Reduced)	**YA**	HER	TC
Yugoslavia Reduced Gauss-Krüger Grid	**YG**	HER	TC
Yunnan Province Grid	**YU**		

†[6] grid category, covering more than one possible grid

Note 1. In this case, not all zones use the same projection.

Note 2. For US State plane coordinate systems with more than one zone, use of the 4-figure grid zone number given in FIPS 70-1 is recommended.

APPENDIX 7 TO ANNEX D: UNITS OF MEASURE CODES

INTRODUCTION

DIGEST defines units of measurement as referenced by ISO 1000 "SI units and recommendations for the use of their multiples and of certain other units." However, there are certain units outside the SI (Système international), some of which are recognized by International Committee for Weights and Measures (CIPM), which need to be included in DIGEST because of their practical importance, i.e. occurrence in DGI datasets. These units have their codes enclosed by parentheses ( ).

When a compound unit is formed by multiplication of two or more units, it can be indicated in one of the following ways:

N • m or N m

DIGEST preference is " N• m" to avoid misinterpretation of the blank space.

When a compound unit is formed by dividing one unit by another, it can be indicated in one of the following ways:

$\frac{m}{s}$ or m/s or $m\,s^{-1}$

The DIGEST preference is "m/s".

Table D-7-1 lists the SI, and commonly recognized (shown in parentheses), units of measure which are most likely to occur within a DIGEST dataset, and their codes (abbreviations) for the various Units of Measure fields of the Data Set Parameter Group.

Table D-7-1. DIGEST unit of measure codes

	UNITS	CODE
	LENGTH	
1.	Micrometres	UM
2.	Millimetres	MM
3.	Centimetres	CM
4.	Decimetres	DM
5.	Metres	M
6.	Kilometres	KM
7.	Inches	(IN)
8.	Feet	(FT)
9.	Yards	(YD)
10.	Fathoms	(FM)
11.	Fathoms and Feet	(FF)
12.	Statute Miles	(MI)
13.	Nautical miles	(NM)
	TIME	
14.	Seconds	S
15.	Minutes	MIN
16.	Hours	H
17.	Days	D
	SPEED	
18.	Metres per Second	M/S
19.	Kilometres per Hour	KM/H
20.	Miles per Hour	(MPH)
21.	Knots	(KNOT)

Table D-7-1. DIGEST unit of measure codes (continued)

	UNITS	CODE
	AREA	
22.	Square metres	(M2)
23.	Square kilometres	(KM2)
24.	Hectares	(HA)
	ANGULAR MEASUREMENT	
25.	Mils	ML
26.	Seconds (of arc)	(SEC)
27.	Minutes (of arc)	(MA)
28.	Degrees (of arc)	(DEG)
	WEIGHT (MASS)	
29.	Kilograms	KG
30.	Kips	(KIP)
	PRESSURE	
31.	Millibars	MBAR
32.	Hectopascals	HPA
	ELECTRICITY	
33.	Volts	V
34.	Kilovolts	KV
35.	Watts	W
36.	Megawatts	MW
37.	Gigawatts	GW
38.	Amperes	A
39.	Hertz	HZ
40.	Kilohertz	KHZ
41.	Megahertz	MHZ
	MISCELLANEOUS	
42.	Beds	(BED)
43.	Features	(FEATURE)
44.	Lanes/Tracks	(LANE/TRACK)
45.	Levels	(LEVEL)
46	Lines	(LINE)
47.	Occults	(OCCULT)
48.	Percent	(%)
49.	Persons	(PERSON)
50.	Qualifiers	(QUALIFIER)
51.	Structures	(STRUCTURE)
52.	Vehicles	(VEHICLE)

Note: Codes enclosed in parentheses indicate non-ISO 1000 units. The parentheses themselves do not form part of the code.

ANNEX E. COMPLEXITY (COMPLIANCE) LEVELS

See JIEO Circular 9008, Table 5-1, for details.